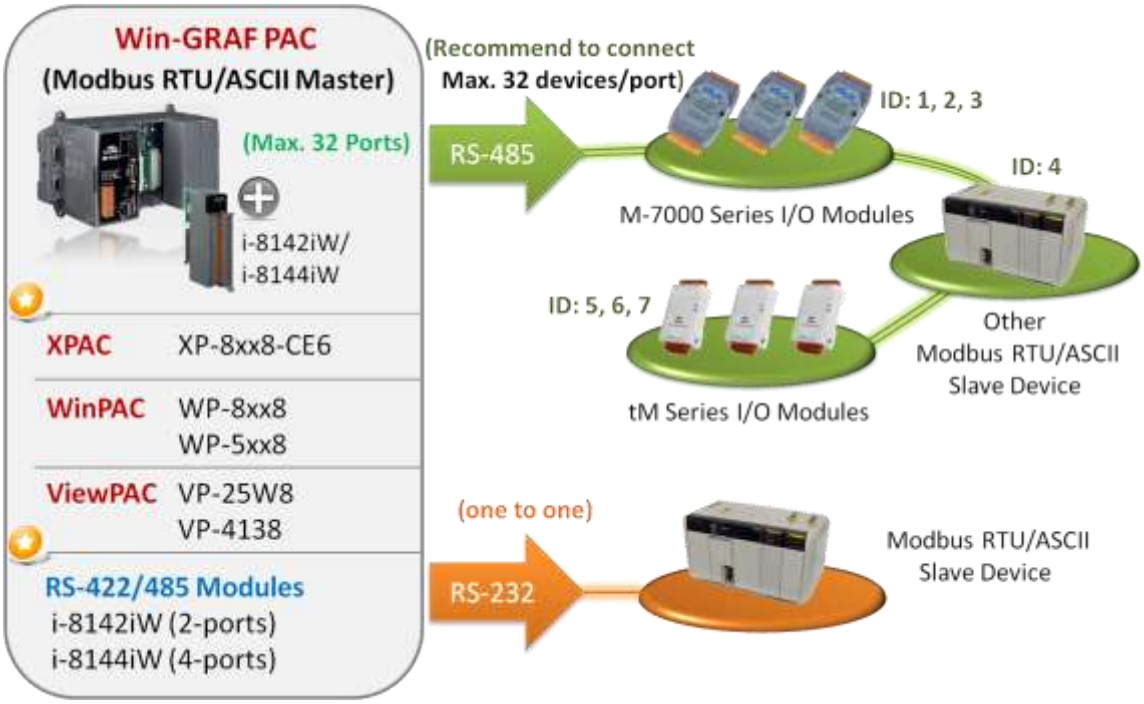
Chapter 5 Modbus Master: connecting to Modbus Slave Devices

This chapter lists the way to enable the Win-GRAF PAC as a Modbus Master to connect Modbus RTU/ASCII Slave or Modbus TCP/UDP Slave devices. If you want to use one XV board in the WP-5xx8, refer the Section 5.1.6 to Section 5.1.11.

5.1 Enabling the Win-GRAF PAC as a Modbus RTU/ASCII Master

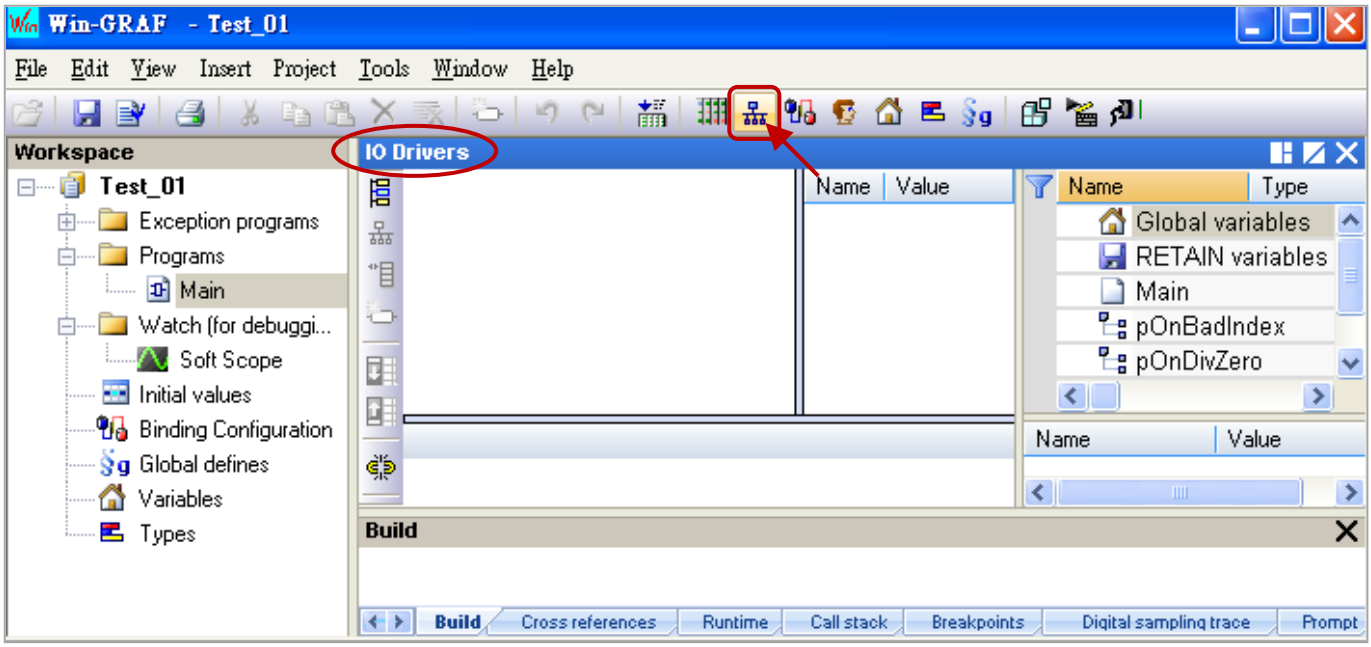
Application Diagram:



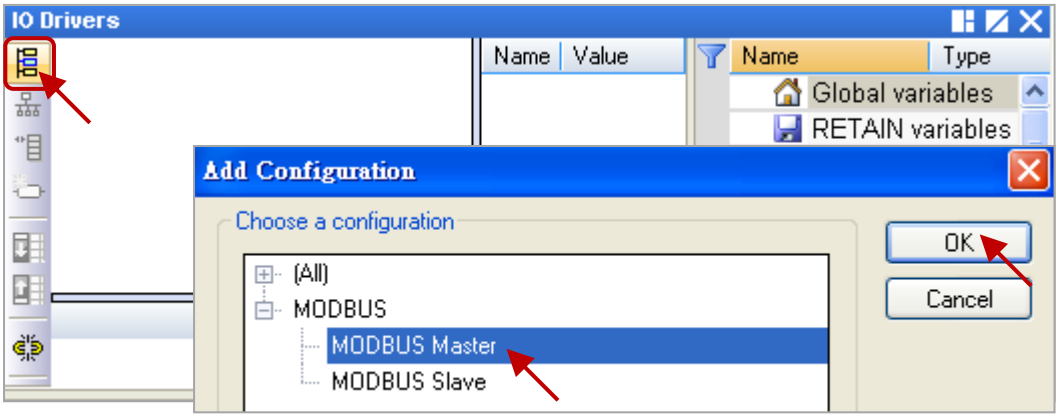
(Refer the P1-1 to view all PAC models)

Follow these steps:

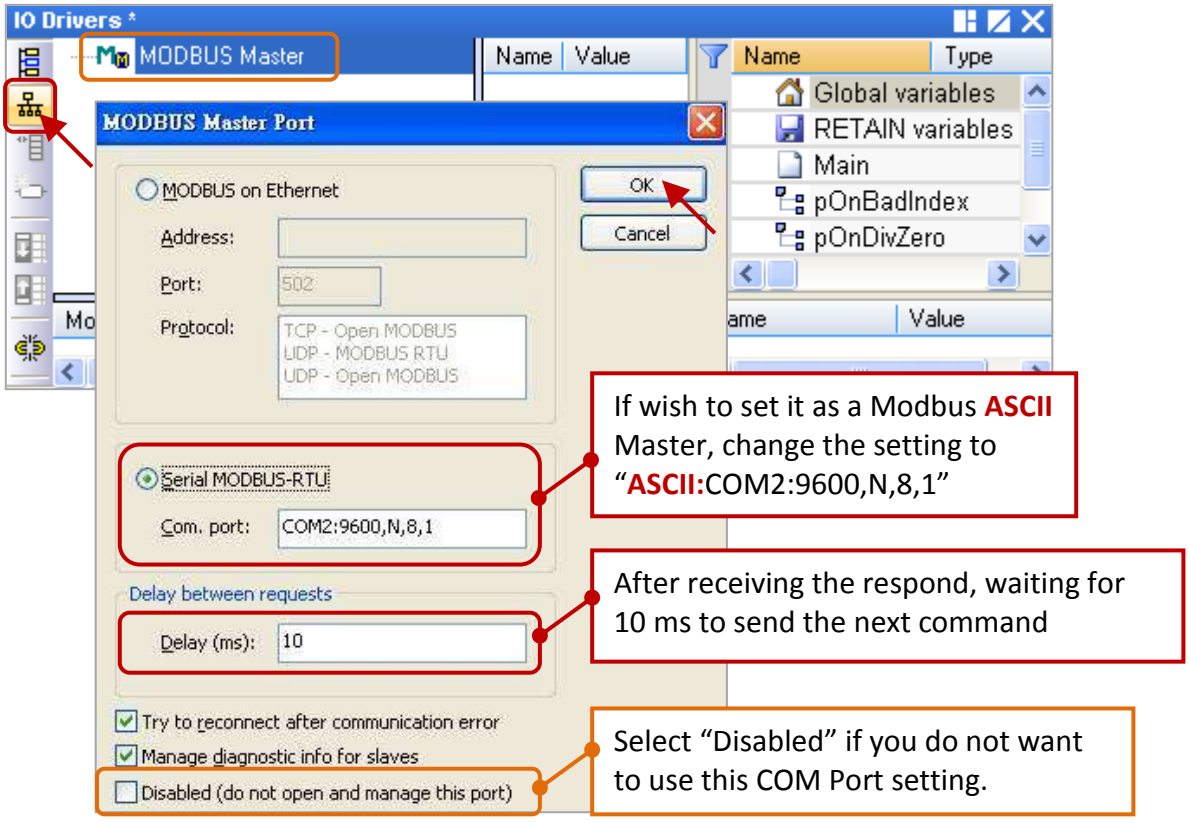
1. Mouse click the “Open Fieldbus Configuration” tool button to open “IO Drivers” window.



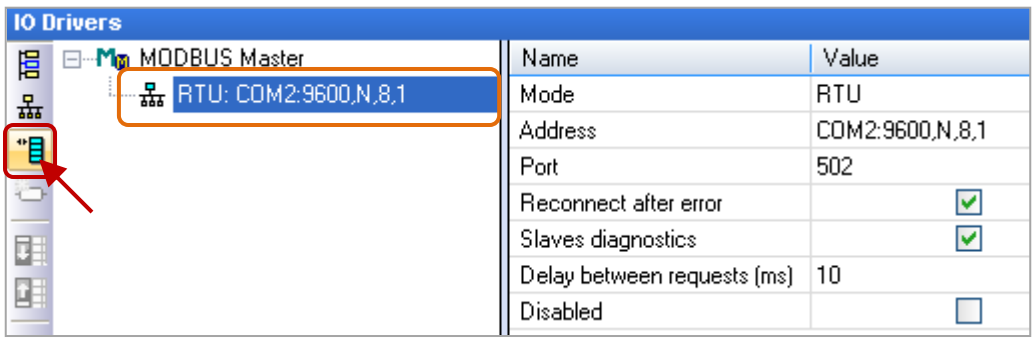
2. Click the “Insert Configuration” button on the left of the “IO Drivers” window, then click the “MOSBUS Master” and “OK” to enable the Modbus Master setting.



3. Click the “Insert Master/Port” button on the left side to open the setting window. Then, select the “Serial MODBUS-RTU”, set COM Port (e.g., “COM2:9600,N,8,1”) and Delay time (recommended value: 10 ms, it can be 0 to 10000), and then click “OK”.



4. Click the “Insert Slave/Data Block” button on the left side to create a data block.

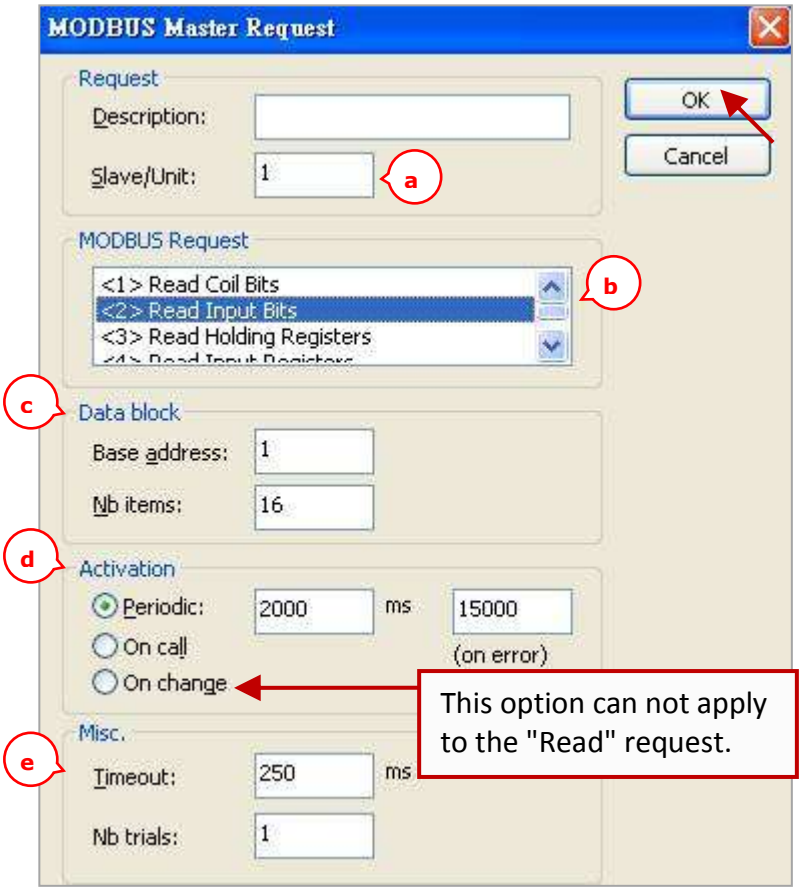


This table lists five data blocks, and each data block stands for one Modbus Master Request.

Item	Function Code	Modbus Request	Description
1	2	Read Input-bits	Read DI data
2	5	Write single coil-bit	Write DO data
3	4	Read Input Registers	Read AI data
4	6	Write single holding register	Write one AO data (16-bit)
5	16	Write Holding Registers	Write multiple AO data (16/32 bits)

5.1.1 Read DI data

1. Completing all the following settings in the “MODBUS Master Request” window, and then click “OK".

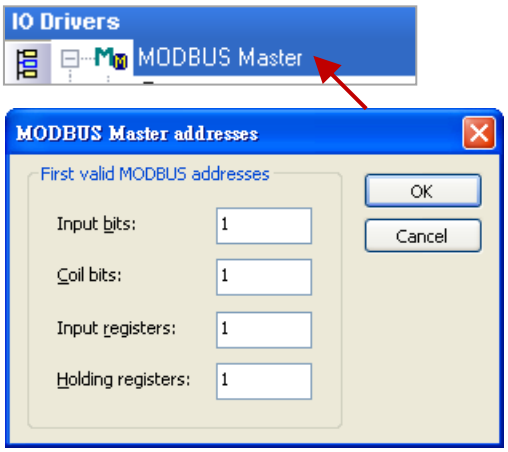


a. Slave/Unit:
Enter the Net-ID of the Slave device.
(In this case, the Net-ID is “1”).

b. MODBUS Request:
Select “<2> Read Input Bits” option.

c. Base address:
Start from “1” by default.
Nb items:
The number of DI signals to read.
(In this case, the number is “16”).

Note:
If you want to change the “Base address”, right-click the “MODBUS Master” and then select the “MODBUS Master Addresses” to modify the value.



d. Activation: The way to send the Modbus request.

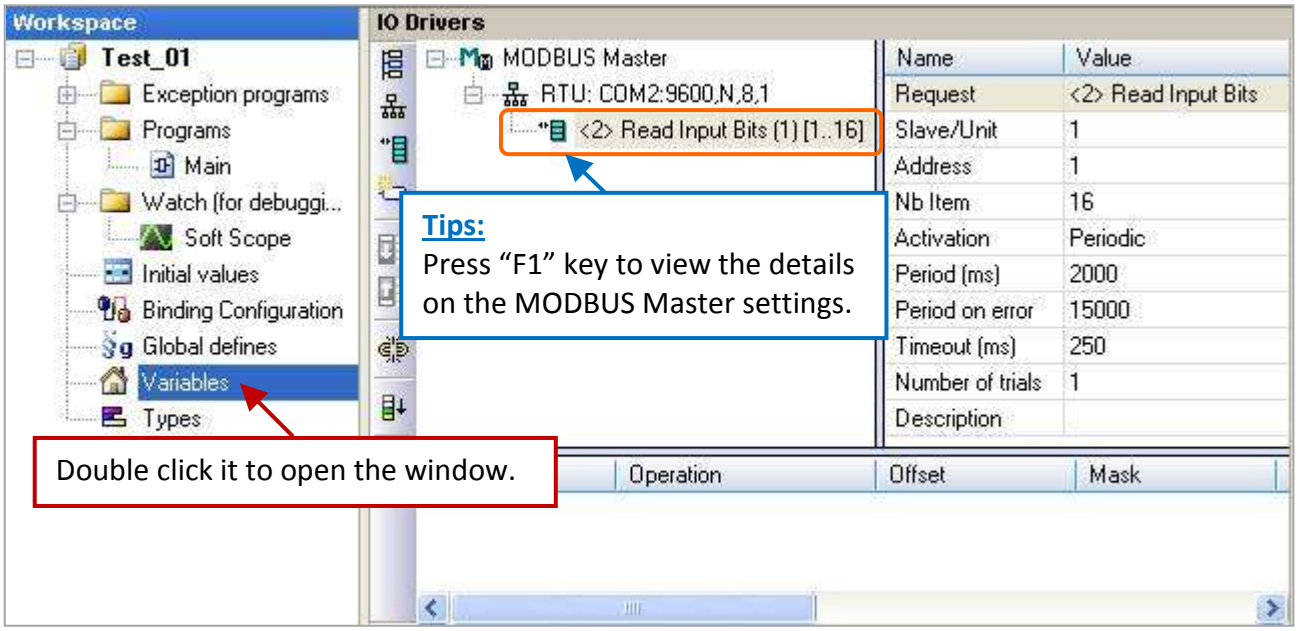
Periodic: Sending the request periodically.
(In this case, to send once every two seconds.)
“on error” means the next sending time when an exception occurred (e.g., 15 seconds).

On call: The request is activated when a program call to send it

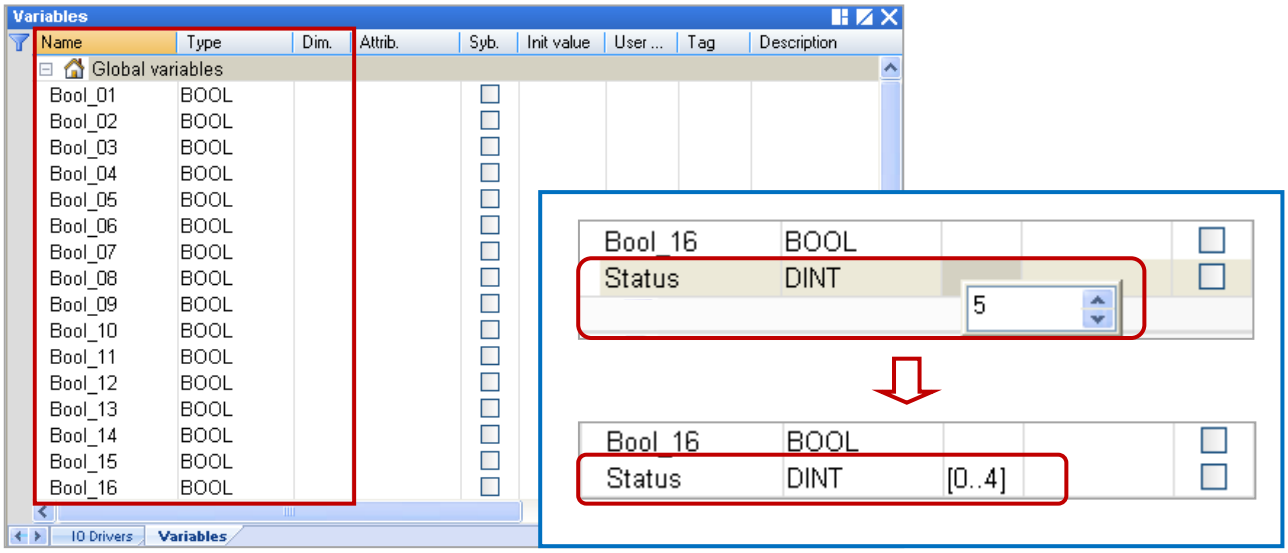
On change: In case of a write request, means that the request is activated each time any variable changed.

e. Timeout: Set a timeout value. (When time-out occurred, it will show the defined error code.)
(The recommended value for the Modbus RTU/ASCII device is 200 to 1000 ms.
In this case, the value is 250 ms)

2. Next, open the “Variables” window and then declare variables that are available for the program.



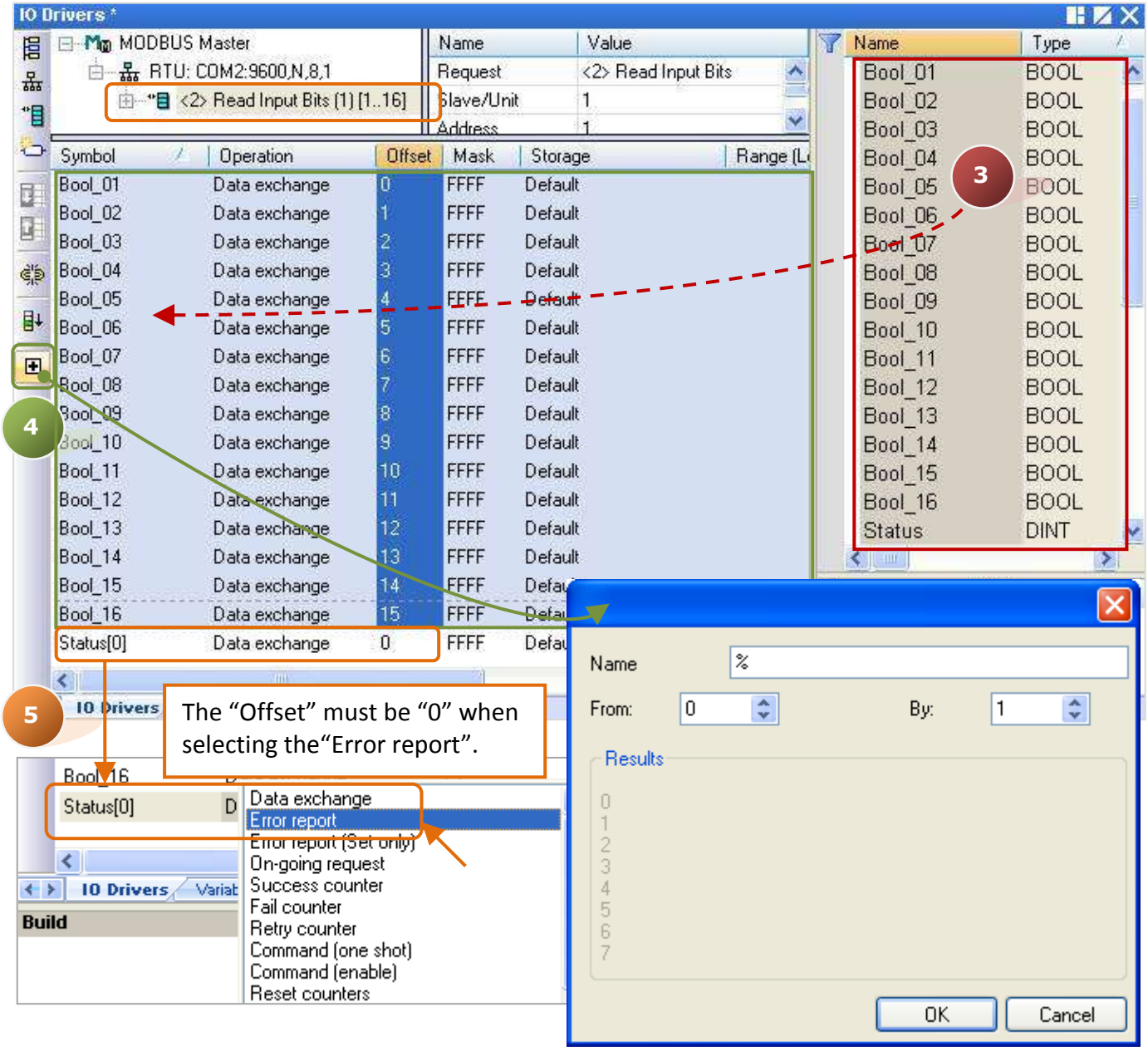
Declaring 16 variables to read data (Name: “Boo_01 to Boo_16”; Type: BOOL) and one array variable to record the state of data access (Name: “Status"; Dim.: 5; Type: DINT). Refer the Sectin 2.3.1 for the way to declare variables, and the figure below shows defined variables.



3. In the "IO Drivers" window like the figure below, drag all required variables in the Variables Area (i.e., “Bool_01” to “Bool_16” and “Status”) and drop them to the “Symbol” area in the first data block.
   Note: The “Status” is an array variable, so, the Status[0] to Status[4] will show on the “Symbol” area.
   Click the “Del” key to delete the Status[1] to Status[4].

4. Next, select “Offset” field from “Boo_01” to “Boo_16” and then click the “Iterate Property” button on the left side to set the “Offset” value (From: “0” ; By: “1”, refer the Section 3.1 – Step8).

5. In the “Operation” field, set the “Status[0]” as “Error report” which means the return value is an “Error Code” if a read error occurred and the value will be reset to “0” if read successfully.

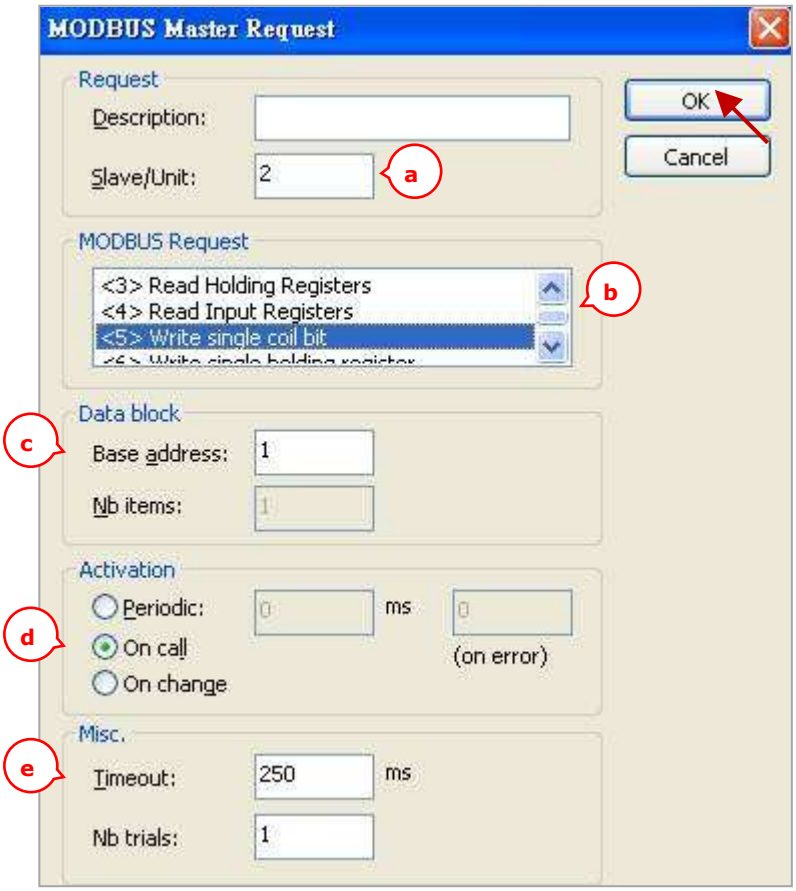


You can also press “F1” in this “IO Drivers” window to see details on Modbus Master Configuration.

Error Code	Description	Error Code	Description
0	The communication is OK.	8	Data Parity Error.
1	MODBUS function not supported.	10	Invalid gateway path.
2	Invalid MODBUS address.	11	Gateway target failed.
3	Invalid MODBUS value.	128	Communication timeout.
4	MODBUS Server failure.	129	Bad CRC16.
6	Server is busy.	130	RS-232 communication error.

5.1.2 Write DO Data

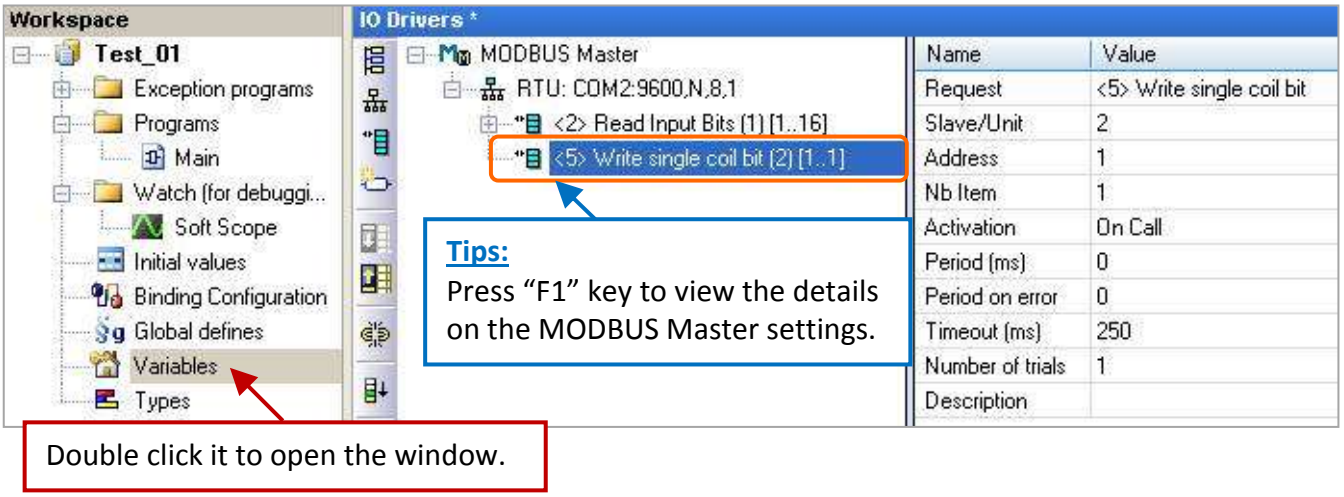
1. Using the same way in the Section 5.1 - Step 4 to create the second data block and completing all the following settings in the “MODBUS Master Request” window, and then click “OK".



In this example

a. Slave/Unit:
   Enter the Net-ID of the Slave device. (e.g., the Net-ID is “2”).
b. MODBUS Request:
   Select “<5> Write single coil bit”.
c. Base address:
   Start from “1” by default.
   (Refer the Section 5.1.1 to change it.)
d. On call:
   The request is activated when a program call to send it
   (Refer the Section 5.1.1 for details)
e. Timeout: Set a timeout value.
   When time-out occurred, it will show the defined error code. (The recommended value for the Modbus RTU/ASCII device is 200 to 1000 ms. In this case the value is 250 ms.)

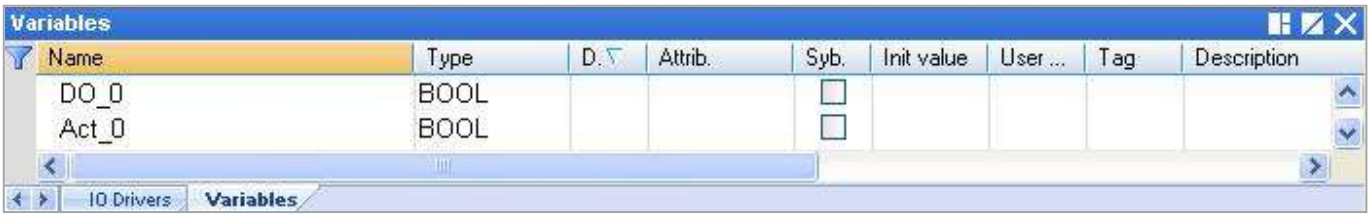
2. Next, open the “Variables” window and then declare variables that are available for the program.



Add two boolean variables in the "Variables" window (refer the Section 2.3.1 for declaring variables).

Variable name	Data type	Description
DO_0	BOOL	Used to Write digital output data.
Act_0	BOOL	In this case, choose the “On call” way to write data that means using a variable to call it.

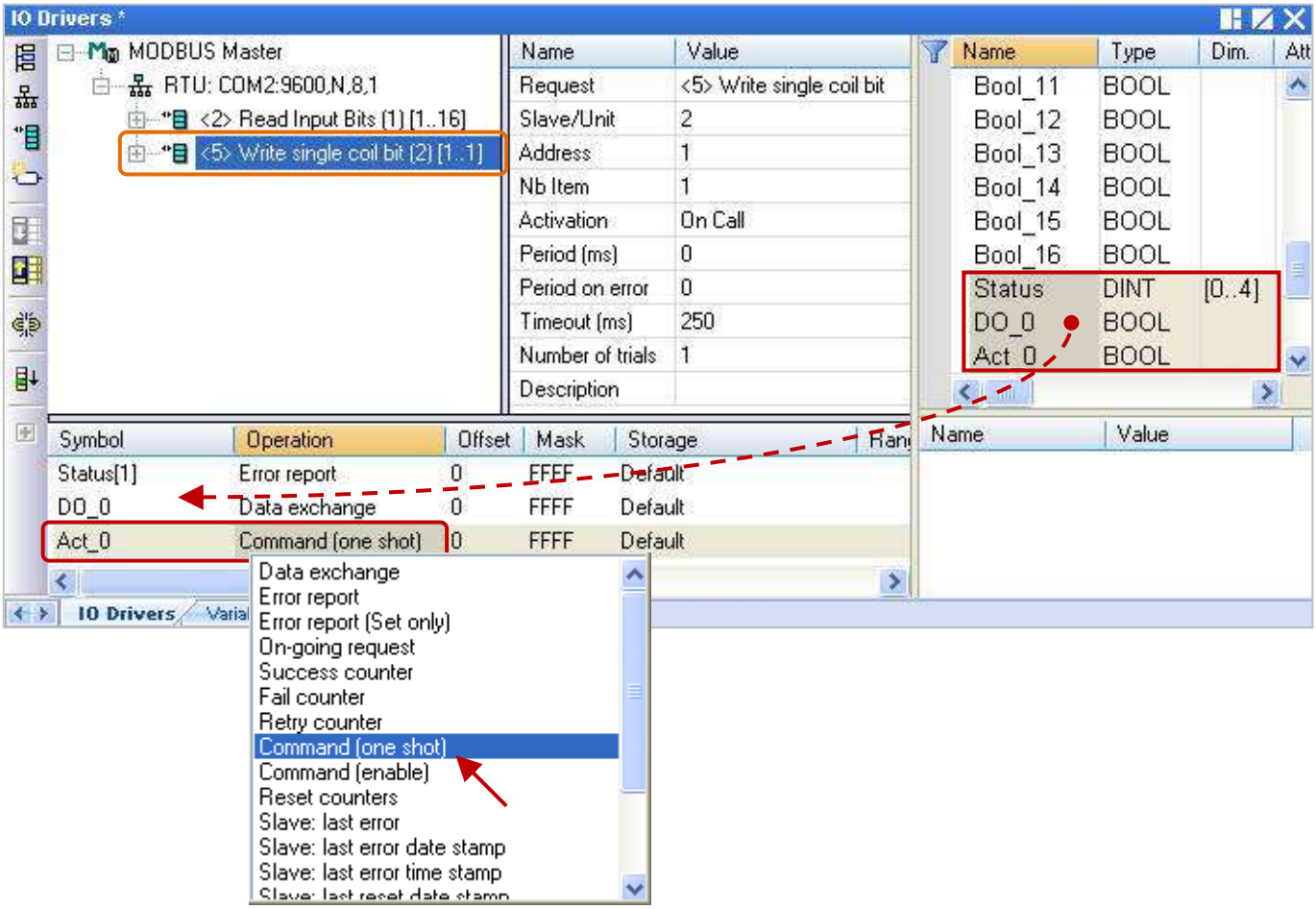
After completing the settings, the defined variables show as below:



3. In the “IO Drivers” window, drag variables - “DO_0”, “Act_0” and “Status” (that created in the Section 5.1.1) from the Variables Area to the Symbol Area in the second data block.
   Note: The “Status” is an array variable. When you drag “Status” into the Symbol Area, it will show “Status[0]” to “Status[4]", simply *press “Del” key to delete “Status[0]” and “Status[2] to [4]".*

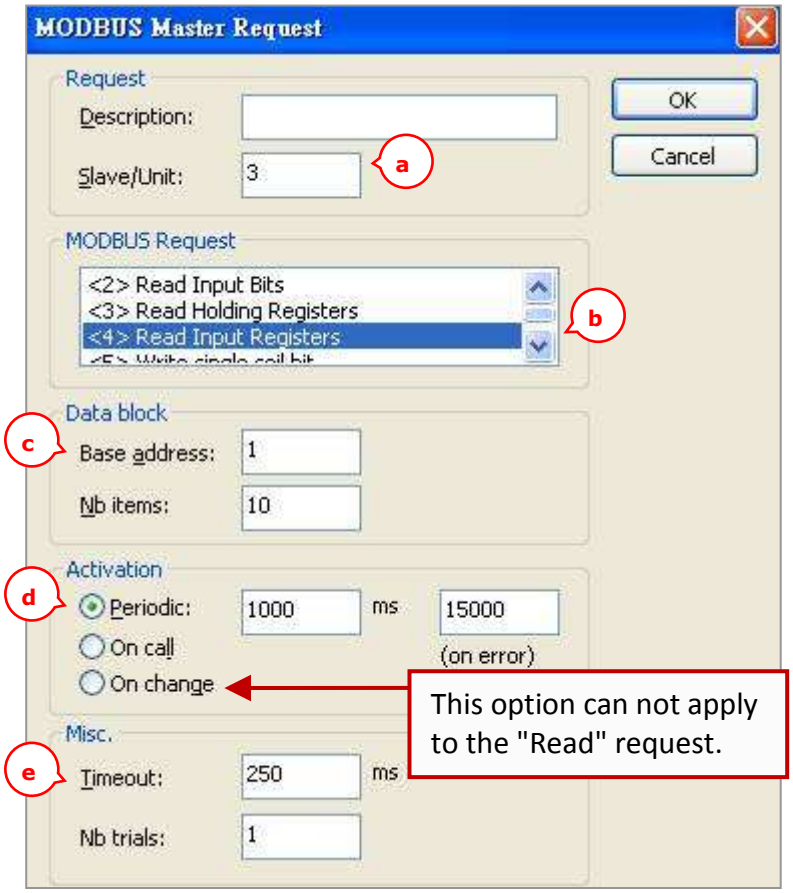
4. Set the “Operation” field of the “Status[1]” as “Error report” (that means this variable will be set to an error code when a read error occurs, or reset it to “0” when a read request is successful).
   Press the “F1” key to see the description of the Modbus Master Configuration and move to the title “Status and command variables” to know related commands and error codes.

5. Set the “Operation” field of “Act_0” as “Command (one shot)” (that means the request will be sent only once when “Act_0” is set to “TRUE”. Then, this “Act_0” will auto reset to “FALSE”).
   The "Command (Enable)” means the request is sent continuously as long as the “Act_0” is “TRUE”. So, users can set the “Act_0” to “FALSE” to stop sending command.



5.1.3 Read AI Data

1. Using the same way in the Section 5.1 - Step 4 to create the third data block and completing all the following settings in the “MODBUS Master Request” window, and then click “OK".



In this example

a. Slave/Unit:
Enter the Net-ID of the Slave device.
(e.g., the Net-ID is “3”).

b. MODBUS Request:
Select “<4> Read Input Registers”.

c.

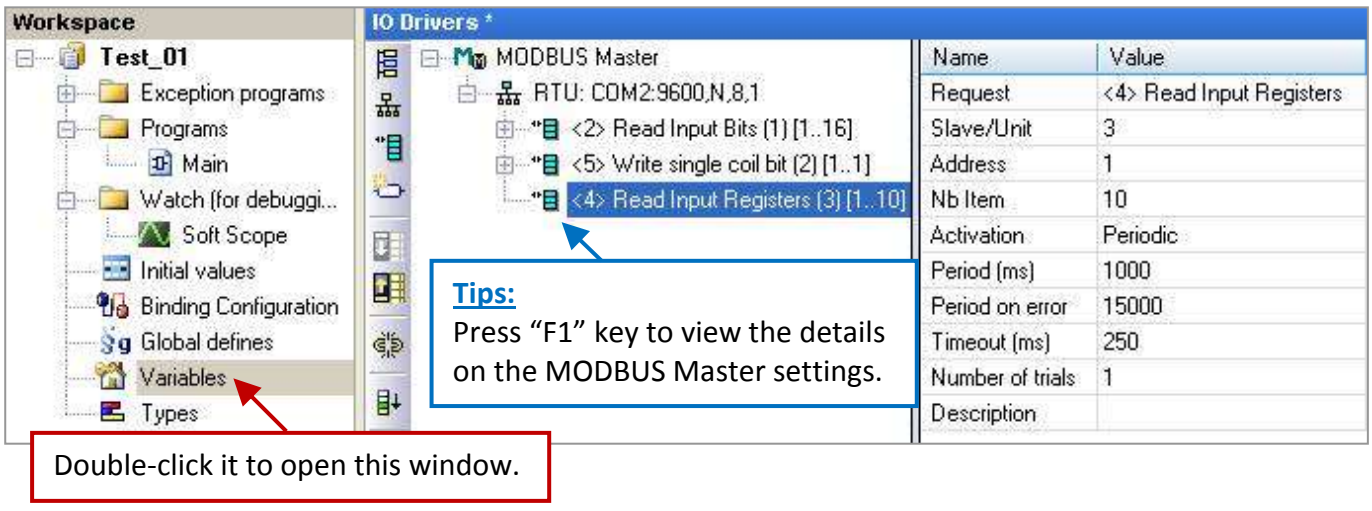
d. Base address:
Start from “1” by default.
(Refer the Section 5.1.1 to change it.)
Nb items:
The number of AI signals to write.
(In this case, the number is “10”).

e.

d. Periodic: (Refer the Section 5.1.1)
Sending the request periodically.
(In this case, to send once per second.)
“on error” means the next sending time when an exception occurred (e.g., 15 seconds).

e. Timeout: Set a timeout value.
When time-out occurred, it will show the defined error code. (The recommended value for the Modbus RTU/ASCII device is 200 to 1000 ms. In this case the value is 250 ms.)

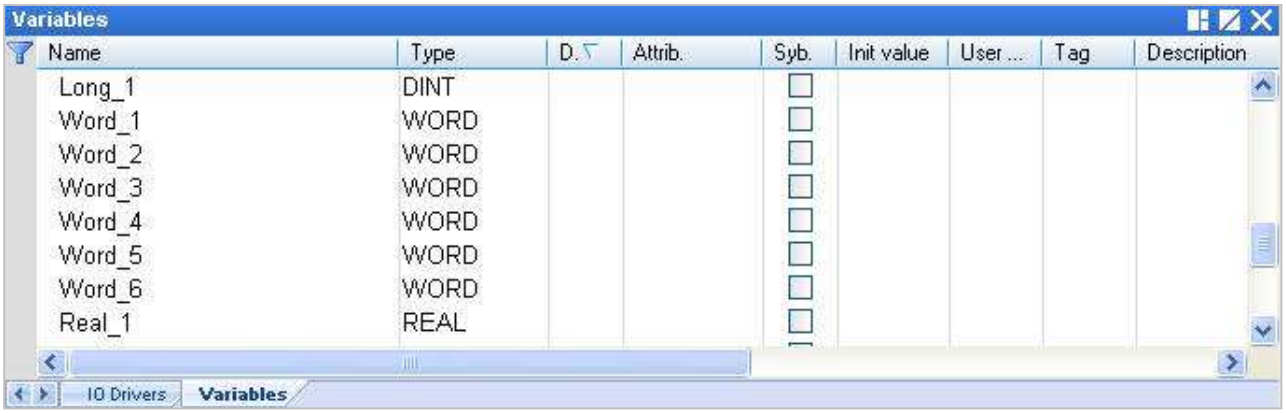
2. Next, open the “Variables” window and then declare variables that are available for the program.



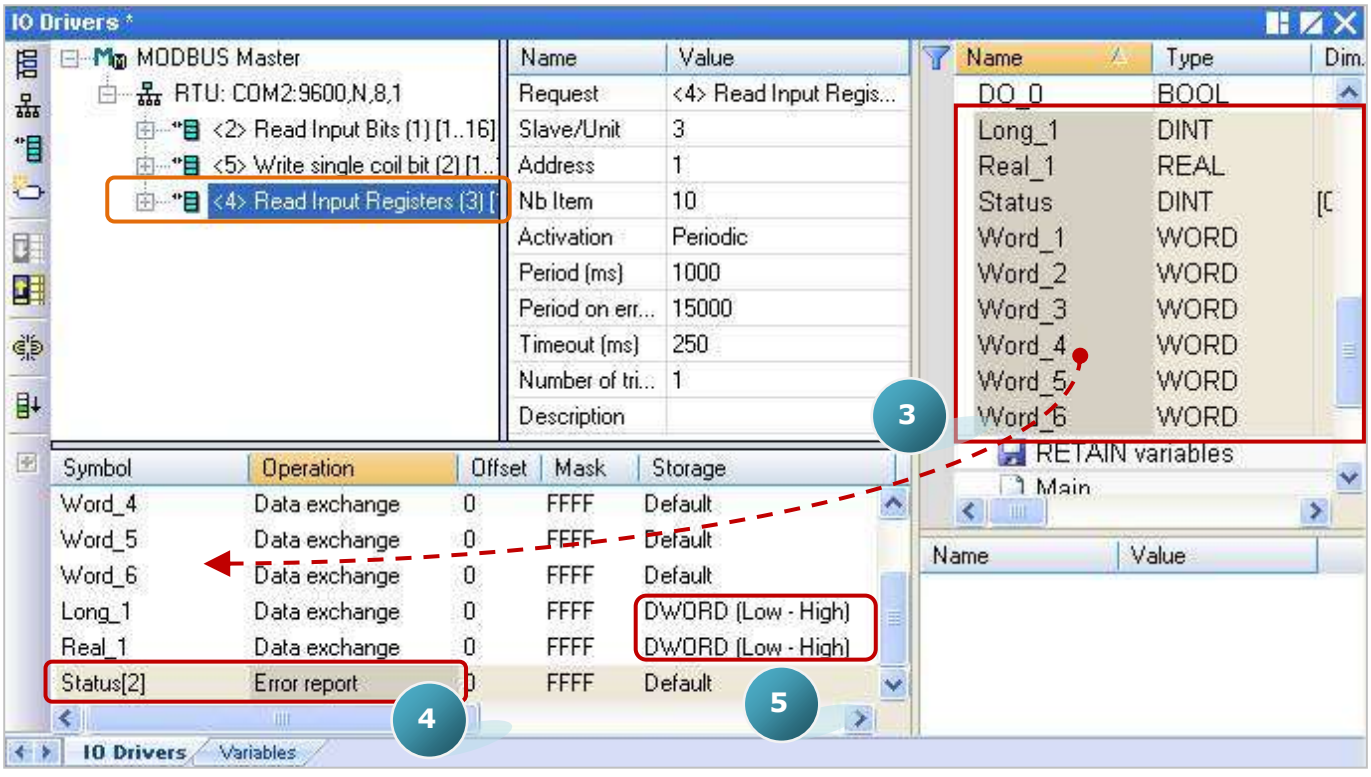
Follow the table below to add six Word (16-bit), one Double integer (32-bit) and one Real (32-bit) variables. (Refer the Section 2.3.1 for declaring variables).

Variable name	Data type	Description
Word_1 to Word_6	WORD	Used to Read AI data (16-bit).
Long_1	DINT	Used to Read AI data (32-bit).
Real_1	REAL	Used to Read AI data (32-bit).

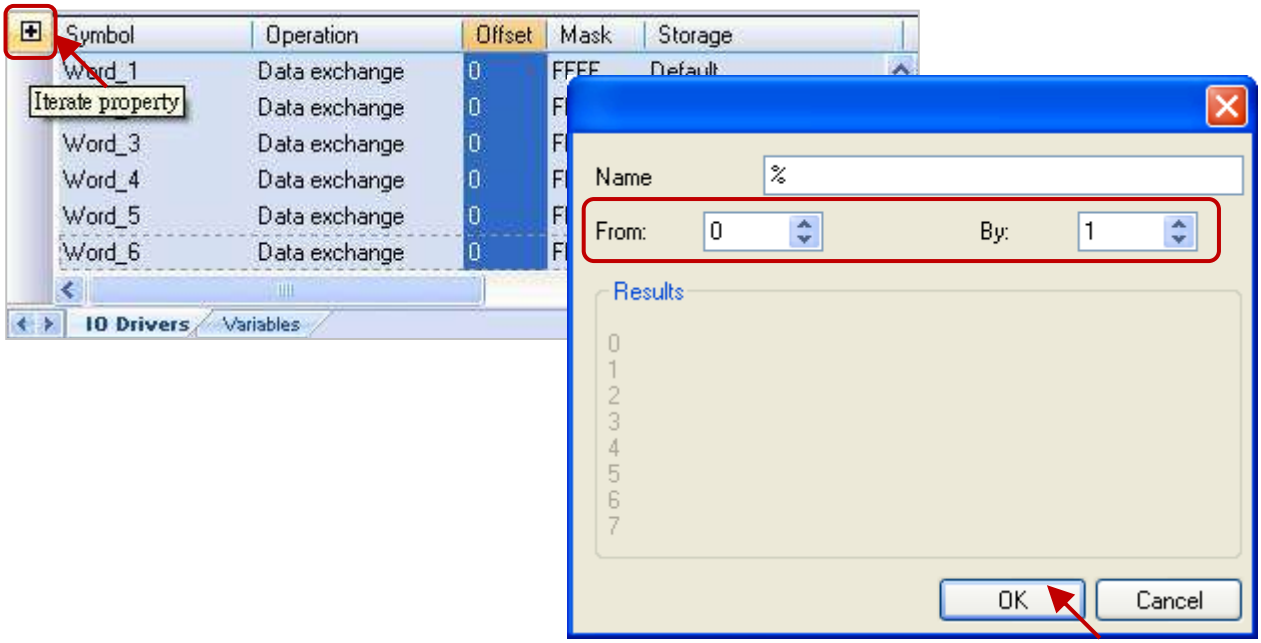
Refer the Appendix A for details on data type and ranges. After completing the settings, the defined variables show as below:



3. In the "IO Drivers" window, drag variables - "Word_1 to Word_6", "Long_1", "Real_1" and "Status" (that created in the Section 5.1.1) from the Variables Area to the Symbol Area in the third data block. **Note:** The "Status" is an array variable. When you drag "Status" into the Symbol Area, it will show "Status[0]" to "Status[4]", simply *press "Del" key to delete "Status[0] to [1]" and "Status[3] to [4]".*
4. Set the "Operation" field of the "Status[2]" as "Error report" (that means this variable will be set to an error code when a read error occurs, or reset it to "0" when a read request is successful). Press the "F1" key to see the description of the Modbus Master Configuration and move to the title "Status and command variables" to know related commands and error codes.
5. Both the "Long_1" and "Real_1" are 32-bit variables and require two Modbus addresses. So, set their "Storage" column as "DWORD (Low – High)".



6. As the figure below, select the "Word_1" to "Word_6" and then click "Iterate property" to set their Offset value (From: 0 ; By: 1).

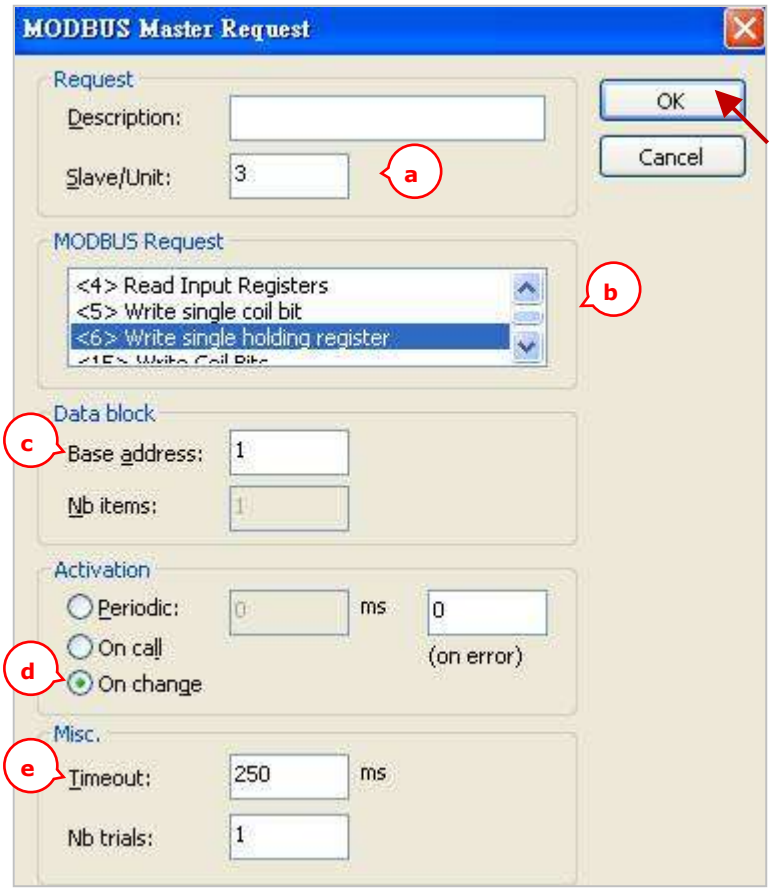


7. Next, double click the Offset field of "Long_1" and "Real_1" items and set their values as "6" and "8", then press "Enter" key to complete the settings.

Note: One 32-bit data requires two Modbus addresses. For instance, the Offset value of "Long_1" is "6" and the next Offset value must be set to "8" (i.e., "Real_1").

5.1.4 Write AO Data (16-bit)

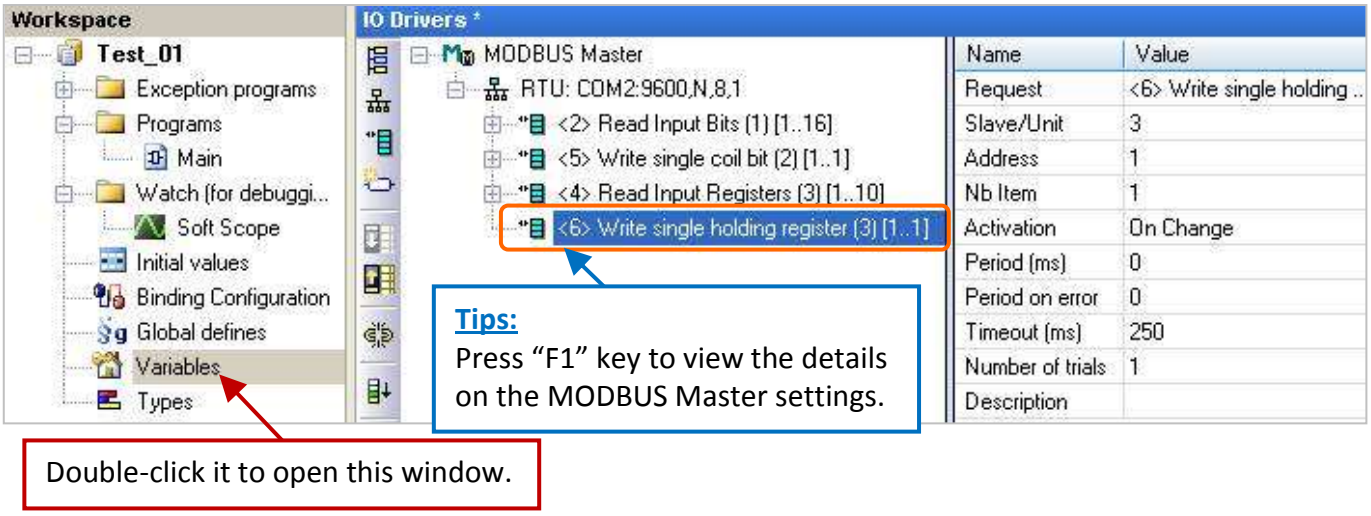
1. Using the same way in the Section 5.1 - Step 4 to create the 4th data block and completing all the following settings in the “MODBUS Master Request” window, and then click “OK".



In this example

a. Slave/Unit:
   Enter the Net-ID of the Slave device. (e.g., the Net-ID is “3”).
b. MODBUS Request: Select “<6> Write single holding register”.
c. Base address:
   Start from “1” by default.
   (Refer the Section 5.1.1 to change it.)
d. On change: In case of a write request, means that the request is activated each time any variable changed.
   (Refer the Section 5.1.1 for derails.)
e. Timeout: Set a timeout value.
   When time-out occurred, it will show the defined error code. (The recommended value for the Modbus RTU/ASCII device is 200 to 1000 ms. In this case the value is 250 ms.)

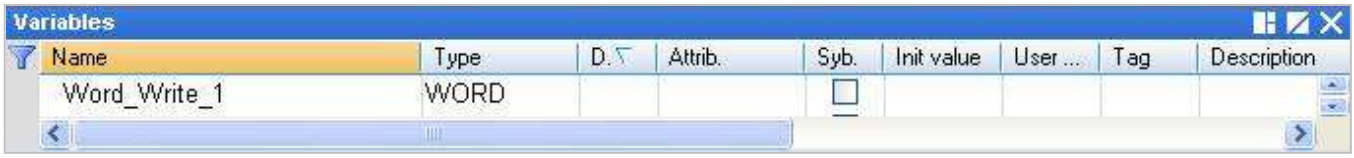
2. Next, open the “Variables” window and then declare variables that are available for the program.



Declaring a "WORD" variable.
(Refer the Appendix A for details on data type and ranges ; refer the Section 2.3.1 for operations).

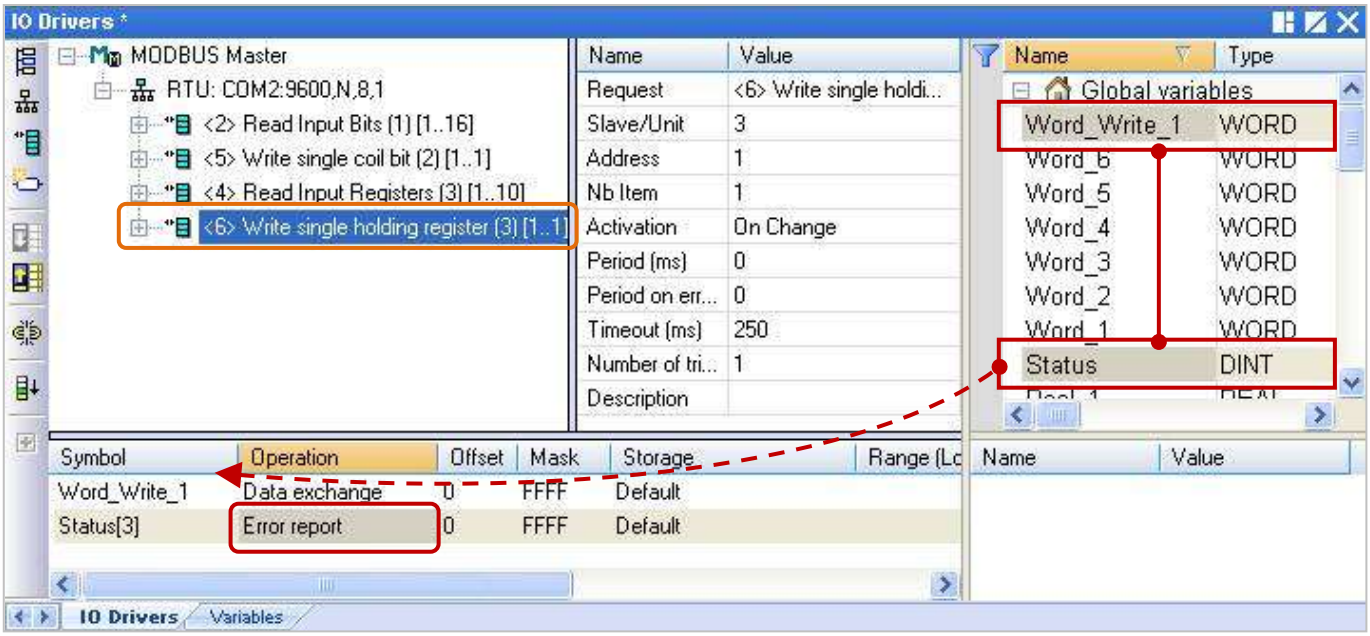
Variable name	Data type	Description
Word_Write_1	WORD	Used to write AO data (16-bit).

After completing the settings, the defined variables show as below:



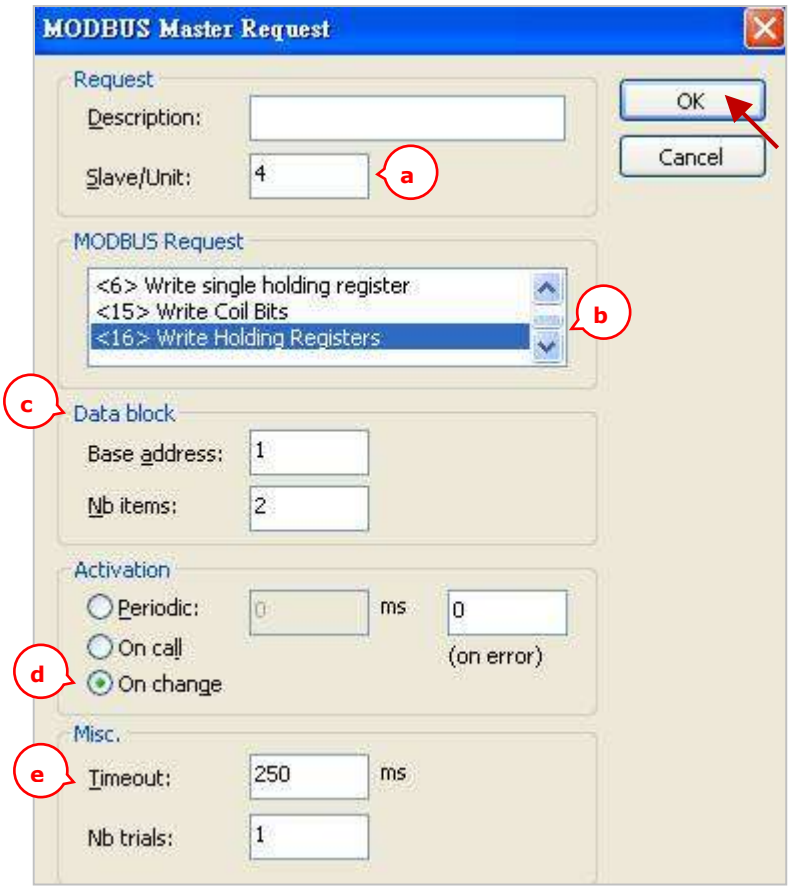
3. In the “IO Drivers” window, drag variables - “Word_Write_1” and “Status” (that created in the Section 5.1.1) from the Variables Area to the Symbol Area in the 4th data block.
   Note: The “Status” is an array variable. When you drag “Status” into the Symbol Area, it will show “Status[0]” to “Status[4]", *simply press “Del” key to delete “Status[0] to [2]” and “Status[4]".*

4. Set the “Operation” field of the “Status[3]” as “Error report” (that means this variable will be set to an error code when a read error occurs, or reset it to “0” when a read request is successful).
   Press the “F1” key to see the description of the Modbus Master Configuration and move to the title “Status and command variables” to know related commands and error codes.



5.1.5 Write AO Data (32-bit)

1. Using the same way in the Section 5.1 - Step 4 to create the 5th data block and completing all the following settings in the "MODBUS Master Request" window, and then click "OK".



In this example

a. Slave/Unit:
Enter the Net-ID of the Slave device. (e.g., the Net-ID is "4").

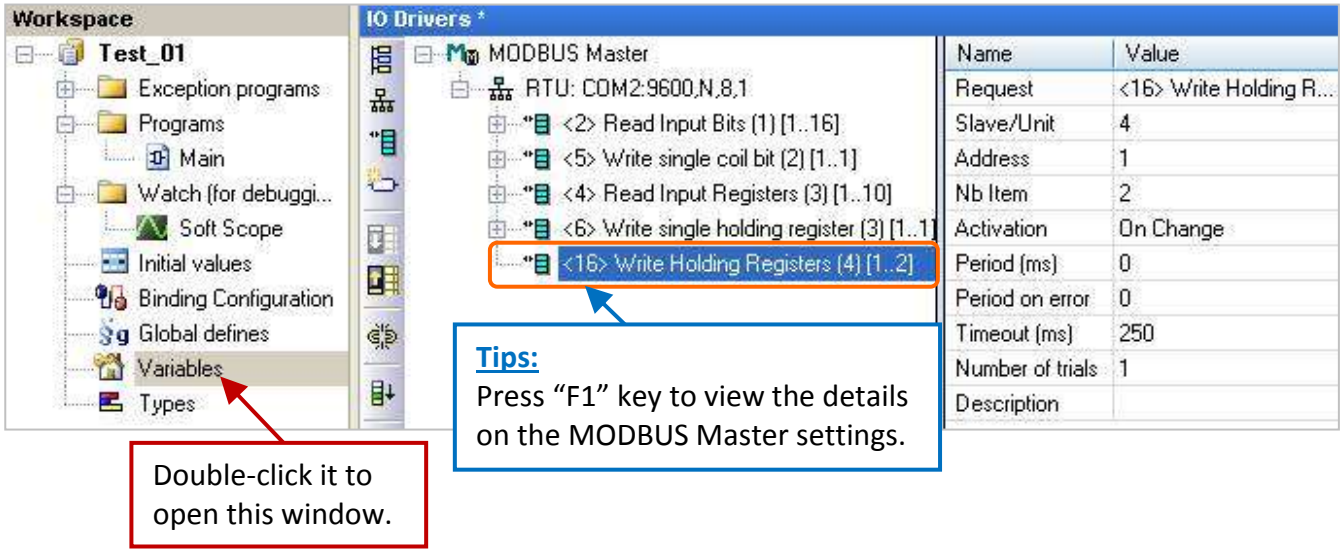
b. MODBUS Request:
Select "<16> Write Holding Registers".

c. Base address:
Start from "1" by default.
(Refer the Section 5.1.1 to change it.)
Nb items:
The number of AO signals to write.
(In this case, the number is "2" because the REAL type requires two Modbus address).

d. On change: In case of a write request, means that the request is activated each time any variable changed.
(Refer the Section 5.1.1 for details)

e. Timeout: Set a timeout value.
When time-out occurred, it will show the defined error code. (The recommended value for the Modbus RTU/ASCII device is 200 to 1000 ms. In this case the value is 250 ms.)

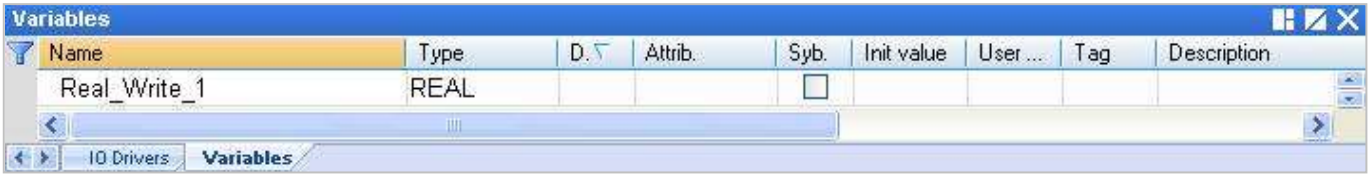
2. Next, open the "Variables" window and then declare variables that are available for the program.



Declaring a "Real" variable.
(Refer the Appendix A for details on data type and ranges ; refer the Section 2.3.1 for operations).

Variable name	Data type	Description
Real_Write_1	REAL	Used to write AO data (32-bit).

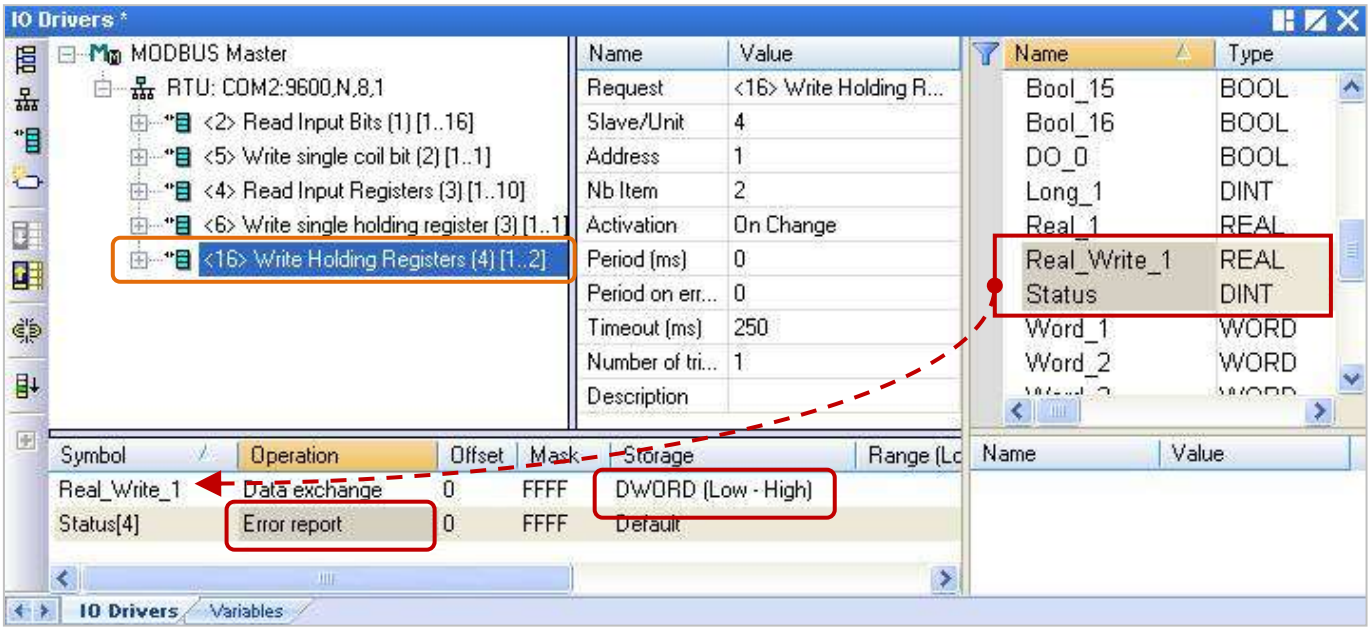
After completing the setting, the defined variable shows as below:



3. In the “IO Drivers” window, drag variables - “Real_Write_1” and “Status” (that created in the Section 5.1.1) from the Variables Area to the Symbol Area in the 5th data block.
   Note: The “Status” is an array variable. When you drag “Status” into the Symbol Area, it will show “Status[0]” to “Status[4]", simply *press “Del” key to delete “Status[0] to [3]”.*

4. Set the “Operation” field of the “Status[4]” as “Error report” (that means this variable will be set to an error code when a read error occurs, or reset it to “0” when a read request is successful).
   Press the “F1” key to see the description of the Modbus Master Configuration and move to the title “Status and command variables” to know related commands and error codes.

5. The “Real_Write_1” is a 32-bit data and required two Modbus addresses. So, set its “Storage” field as “DWORD (Low – High)”.



5.1.6 How to use the XV Board?

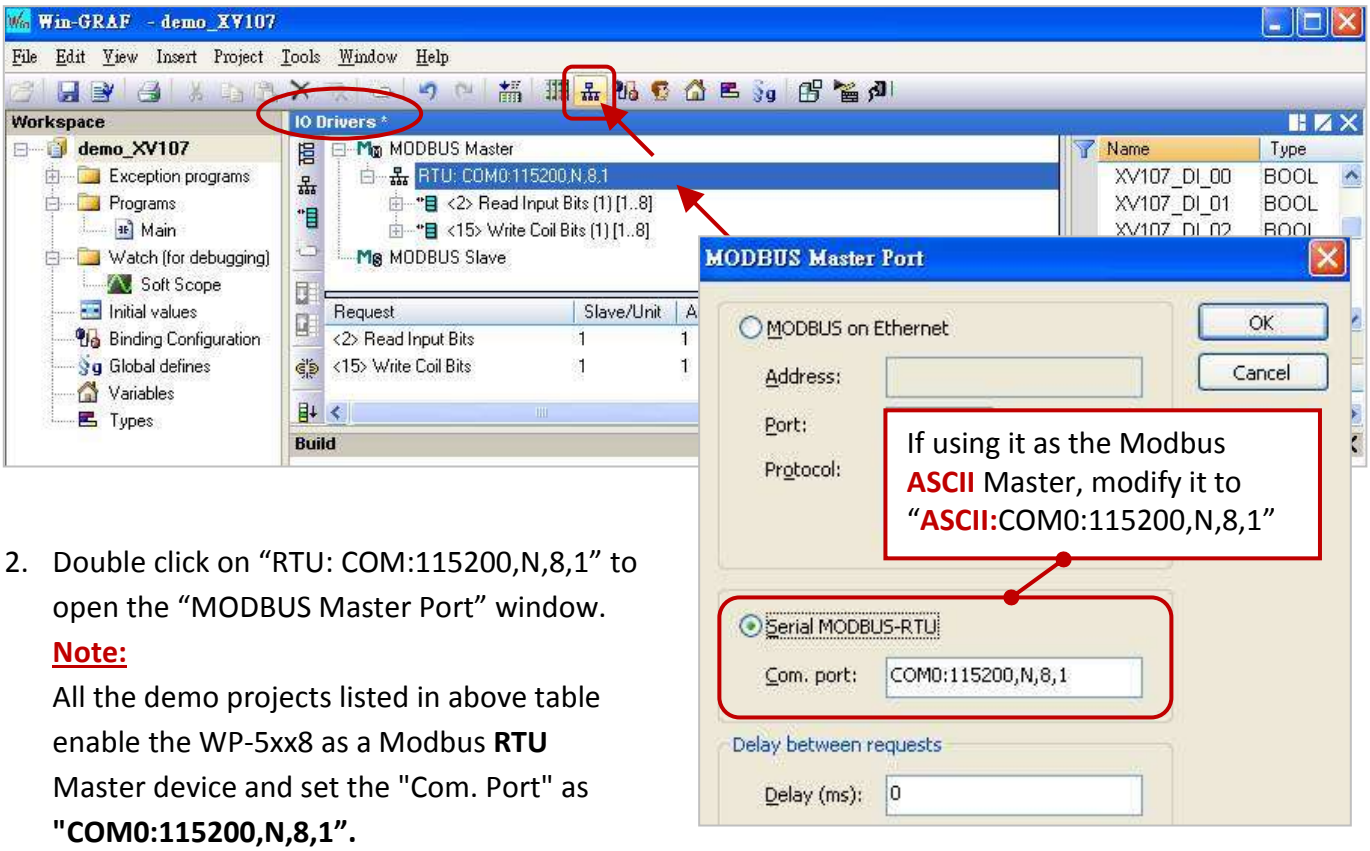
The XV board belongs to the Modbus Slave I/O board. Before using the I/O board, users must plug it into the WP-5xx8, and then enable the WP-5xx8 as a Modbus Master (refer the Section 5.1). Please visit the XV board Selection Guide page to get more details:
www.icpdas.com/root/product/solutions/hmi_touch_monitor/touchpad/xv-board_selection.html

All the Win-GRAF demo projects listed in the following table can be found on the CD-ROM. Refer the Chapter 12, click the Win-GARF menu bar "File" > "Add Existing Project" > "From Zip" to restore the demo project and to view the details. (CD-ROM:\Napdos\Win-GRAF\demo-project\)

Demo	File Name	Description
XV107, XV107A	demo_XV107.zip	Read 8 DI, Write 8 DO
XV110	demo_XV110.zip	Read 16 DI
XV111, XV111A	demo_XV111.zip	Read 16 DO, Read 1 DO
XV116	demo_XV116.zip	Read 5 DI, Write 6 D0
XV308_1 XV308_2 XV308_3	demo_XV308_1.zip demo_XV308_2.zip demo_XV308_3.zip	1. Read 8 AI, Read 8 DI 2. Read 8 AI, Write 8 DO 3. Read 8 AI, Write 4 DO, Read 4 DI
XV310	demo_XV310.zip	Read 4 AI, Write 4 DO, Read 4 DI, Write 4 AO

Common setting:

1. Mouse click the “Open Fieldbus Configuration” tool button to open the “I/O Drivers” window.



2. Double click on “RTU: COM:115200,N,8,1” to open the “MODBUS Master Port” window.

   Note:

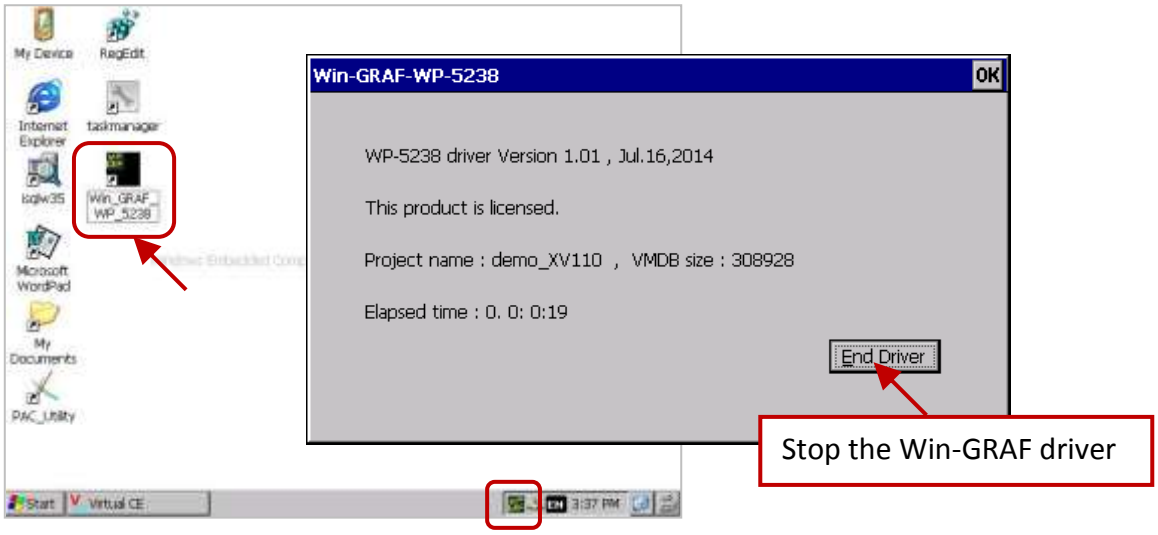
   All the demo projects listed in above table enable the WP-5xx8 as a Modbus **RTU** Master device and set the "Com. Port" as **"COM0:115200,N,8,1”.**

Configure the AI/AO channel

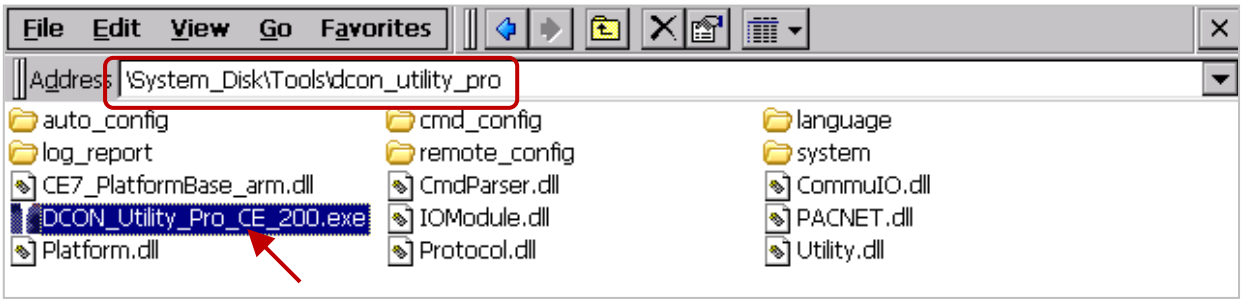
If you want to use the AI/AO channel of the XV Board (e.g., XV308, XV310) in the WP-5xx8. First, stop the Win-GRAF driver in the PAC and then configure each AI/AO channel by using "DCON_Utility_Pro_CE_200.exe".

Using the WP-5238 as an example:

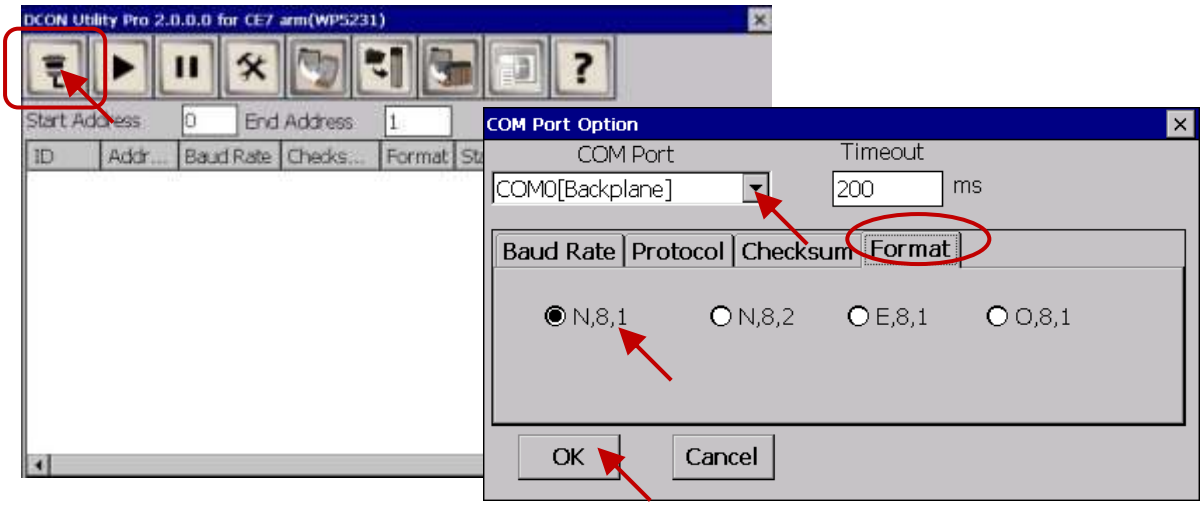
1. Click the "Win_GRAF_WP_5238" (or the small icon on the taskbar) to open the Win-GRAF driver window, and then click the "End Driver" button.



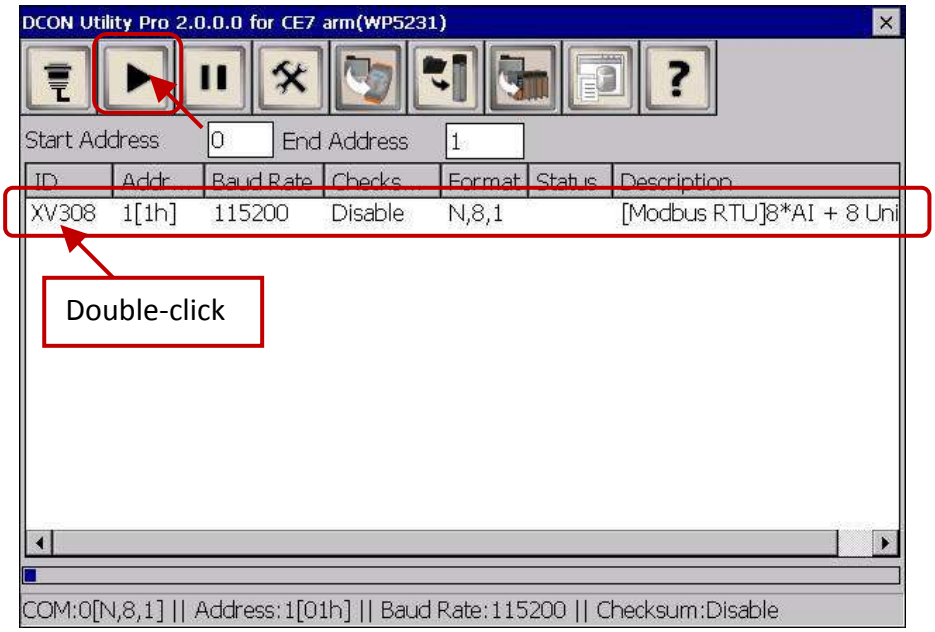
2. Click "My Device" on the desktop and then get into the path "\System_Disk\Tools\dcon_utility_pro" to run the "DCON_Utility_Pro_CE_200.exe".



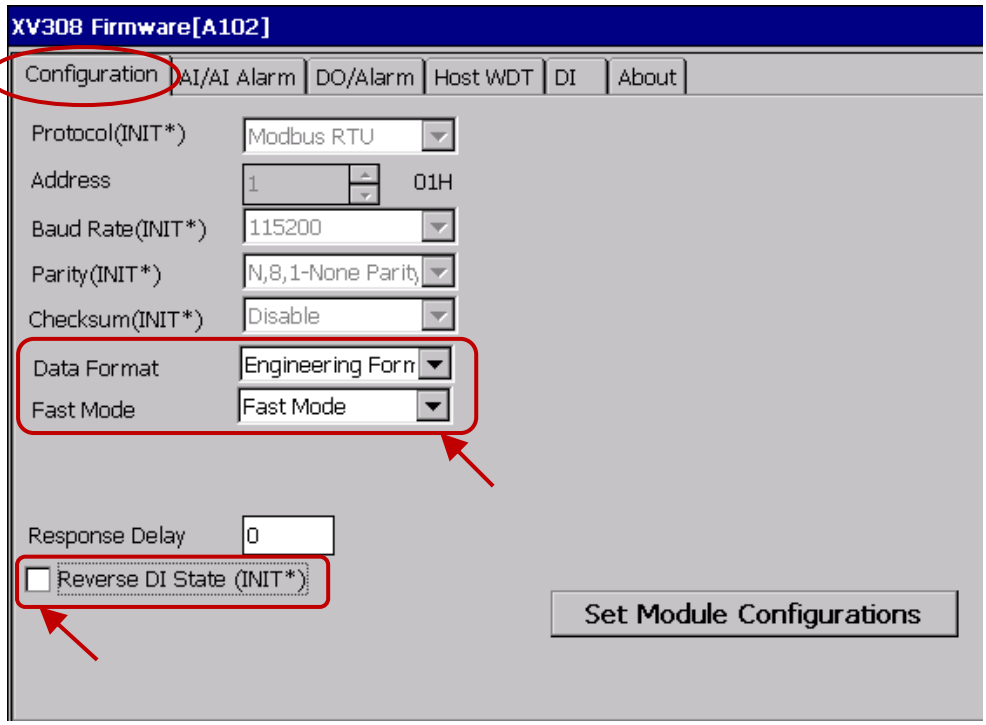
3. Click the COM Port button to set the "COM Port" as "COM0", set the "Baud Rate" as "115200" and set the "Format" as "N,8,1", and then click "OK".



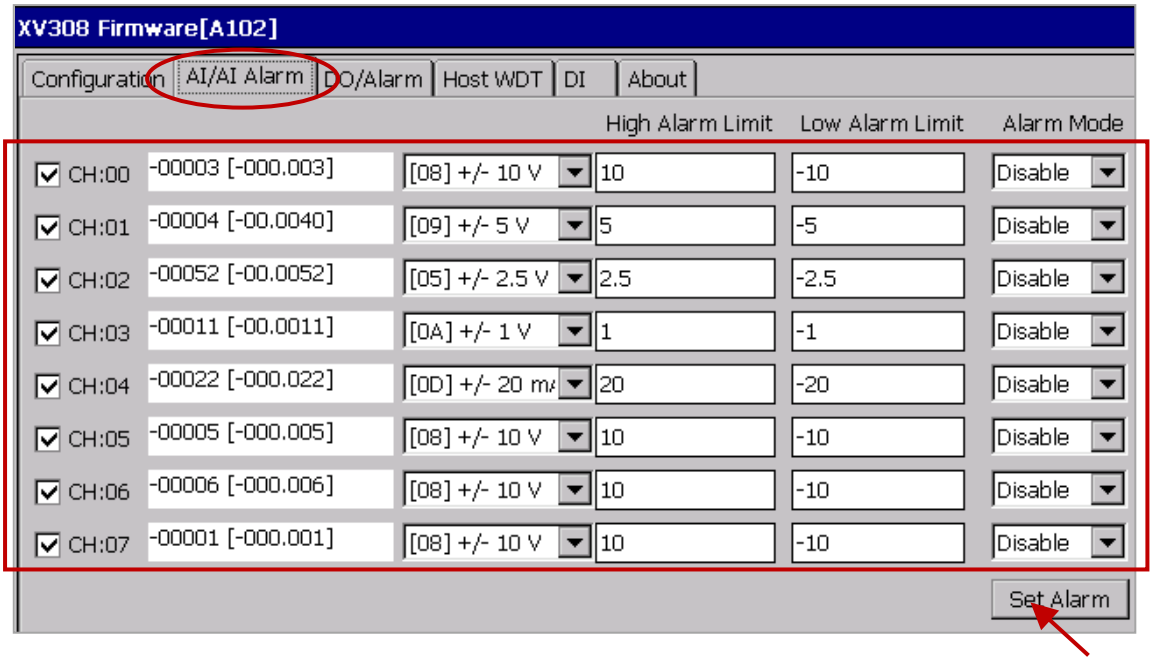
4. After clicking the Search button, the XV Board (e.g., XV308) will show in the window. Then, double click this item to get into the setting window.



5. In the "Configuration" tab, set the "Data Format" as "Engineering Format" (recommended setting), set the "Fast Mode" as "Fast Mode" and uncheck the "Reverse DI State (INIT*)".



6. In the "AI/AI Alarm" tab, to configure the proper ranges and values for each AI channel, and remenmber to select any AI channel (e.g.,"CH:00") you want to use, then click the "Set Alarm" button.



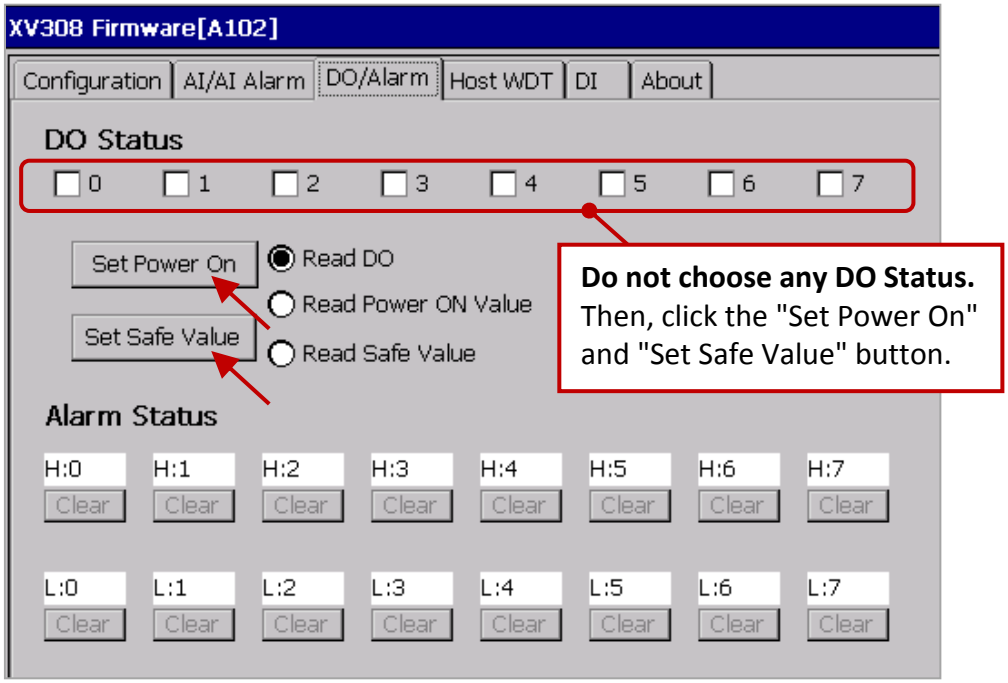
XV308:

Type Code	Range	Data Format	Minimum	Maximum
05	+/-2.5 V	Engineering	-25000	+25000
		Hexadecimal	8000h	7FFFh
06	+/-20 mA	Engineering	-20000	+20000
		Hexadecimal	8000h	7FFFh
07	+4 mA ~ +20 mA	Engineering	+4000	+20000
		Hexadecimal	0000h	FFFFh
08	+/-10 V	Engineering	-10000	+10000
		Hexadecimal	8000h	7FFFh
09	+/-5 V	Engineering	-5000	+5000
		Hexadecimal	8000h	7FFFh
0A	+/-1 V	Engineering	-10000	+10000
		Hexadecimal	8000h	7FFFh
0D	+/-20 mA	Engineering	-20000	+20000
		Hexadecimal	8000h	7FFFh
1A	0 mA ~ +20 mA	Engineering	0	+20000
		Hexadecimal	0000h	FFFFh

Note:

1. For easy to use, recommended to use the data format - "Engineering". (E.g., "+/-2.5 V" will show as "-25000 to +25000" and "+4 mA to +20 mA" will show as "+4000 to +20000")
2. When using these "Type Code" - 06, 07, 0D, 1A, please check if the position of eight hardware jumpers on the XW board are correct.
   www.icpdas.com/root/product/solutions/datasheet/hmi_touch_monitor/XV308.pdf

Note: When using the XV308, you need to click the "Set Power On" and "Set Safe Value" button (do not choose any DO Status) in the "DO/Alarm" tab.



7. Finally, back to the "Configuration" tab and click the "Set Module Configuration" button (Step5) to finish the AI/AO configuration, and then close the "DCON_Utility_Pro_CE_200.exe". In addition, click the "Win_GRAF_WP_5238" on the desktop to run the Win-GRAF driver (like Step 1).

Follow the similar way like the steps above to configure the AI/AO of the XV310.

XV310 - Analog Input:

Type Code	Range	Data Format	Minimum	Maximum
05	+/-2.5 V	Engineering	-25000	+25000
		Hexadecimal	8000h	7FFFh
06	+/-20 mA	Engineering	-20000	+20000
		Hexadecimal	8000h	7FFFh
07	+4 mA ~ +20 mA	Engineering	+4000	+20000
		Hexadecimal	0000h	FFFFh
08	+/-10 V	Engineering	-10000	+10000
		Hexadecimal	8000h	7FFFh
09	+/-5 V	Engineering	-5000	+5000
		Hexadecimal	8000h	7FFFh
0A	+/-1 V	Engineering	-10000	+10000
		Hexadecimal	8000h	7FFFh
0D	+/-20 mA	Engineering	-20000	+20000
		Hexadecimal	8000h	7FFFh
1A	0 mA ~ +20 mA	Engineering	0	+20000
		Hexadecimal	0000h	FFFFh

Note:

1. For easy to use, recommended to use the data format - "Engineering". (E.g., "+/-2.5 V" will show as "-25000 to +25000" and "+4 mA to +20 mA" will show as "+4000 to +20000")
2. When using these "Type Code" - 0, 1, 06, 07, 0D, 1A, please check if the position of eight hardware jumpers on the XW board are correct.
   www.icpdas.com/root/product/solutions/datasheet/hmi_touch_monitor/XV310.pdf

XV310 - Analog Output:

Type Code	Range	Data Format	Minimum	Maximum
0	0 mA ~ +20 mA	Engineering	0	+20000
		Hexadecimal	0000h	FFFFh
1	+4 mA ~+20 mA	Engineering	+4000	+20000
		Hexadecimal	0000h	FFFFh
2	0V ~ +10 V	Engineering	0	+10000
		Hexadecimal	0000h	FFFFh
3	+/-10 V	Engineering	-10000	+10000
		Hexadecimal	8000h	7FFFh
4	0 V ~ +5 V	Engineering	0	+5000
		Hexadecimal	0000h	FFFFh
5	+/-5 V	Engineering	-5000	+5000
		Hexadecimal	8000h	7FFFh

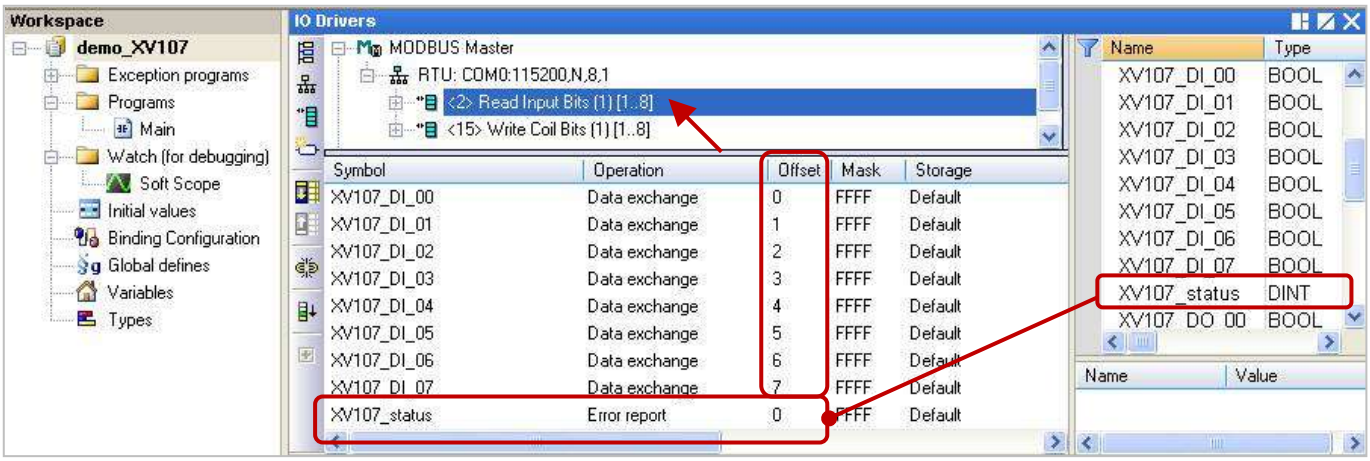
5.1.7 Connecting the XV107/ XV107A (8 DI, 8 DO)

The XV107/XV107A is an 8-channel digital input and 8-channel digital output board. This section provides a Win-GRAF demo project - "demo_XV107.zip". First, go to Section 5.1.6 for the information of the XV Board before using it.

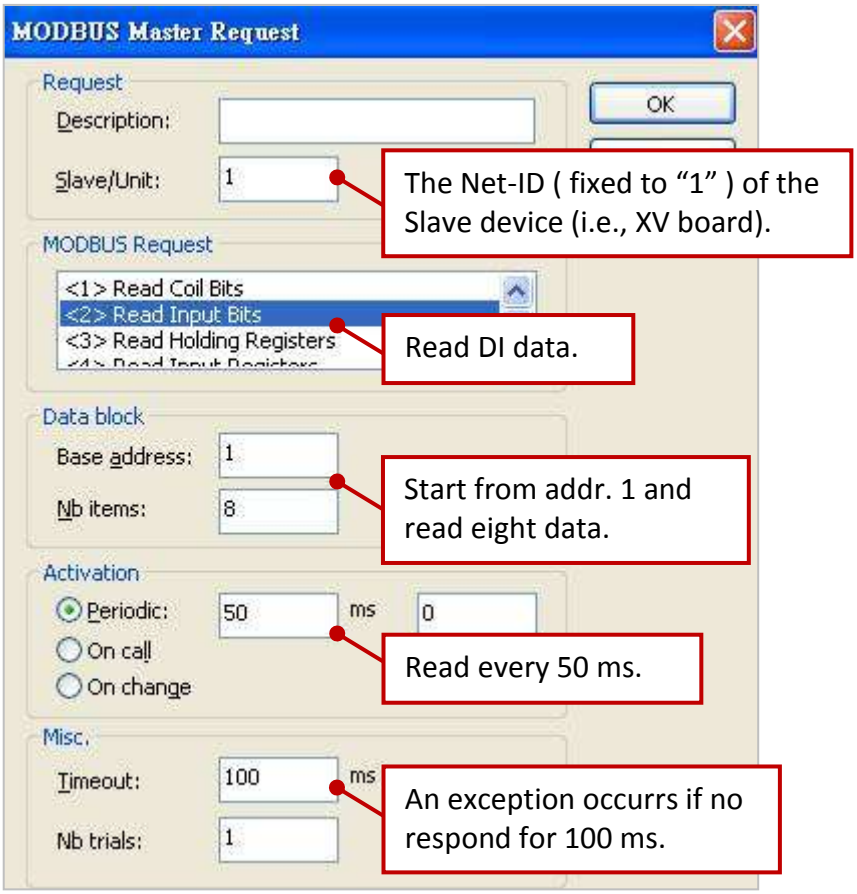
Demo description:

This demo added two data blocks. One is used to read 8 DI data and the other is used to write 8 DO data.

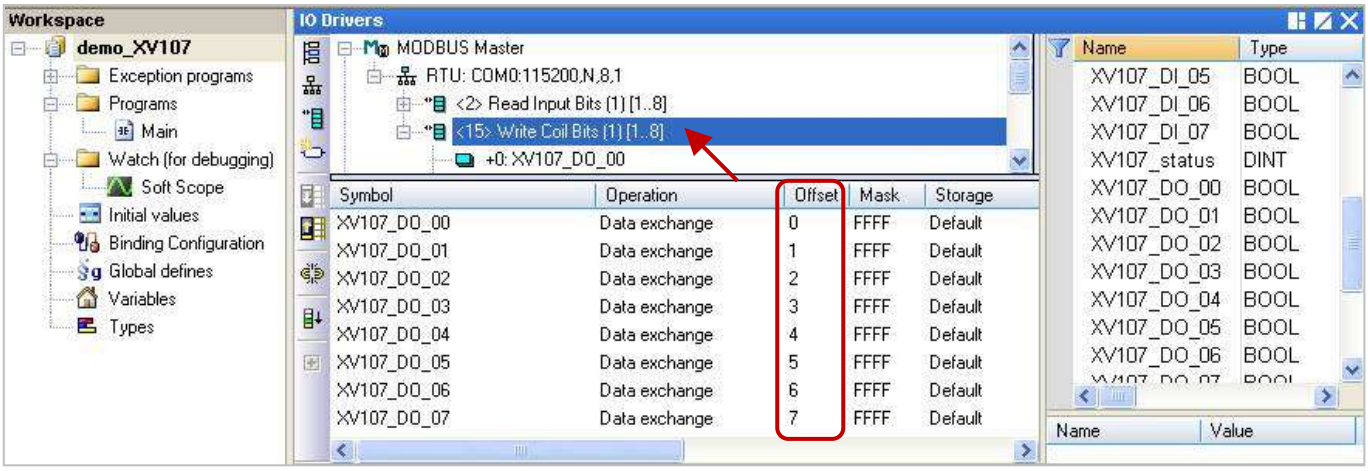
1. Mouse double click the 1st data block (i.e., <2> Read Input Bits) to open the setting window.

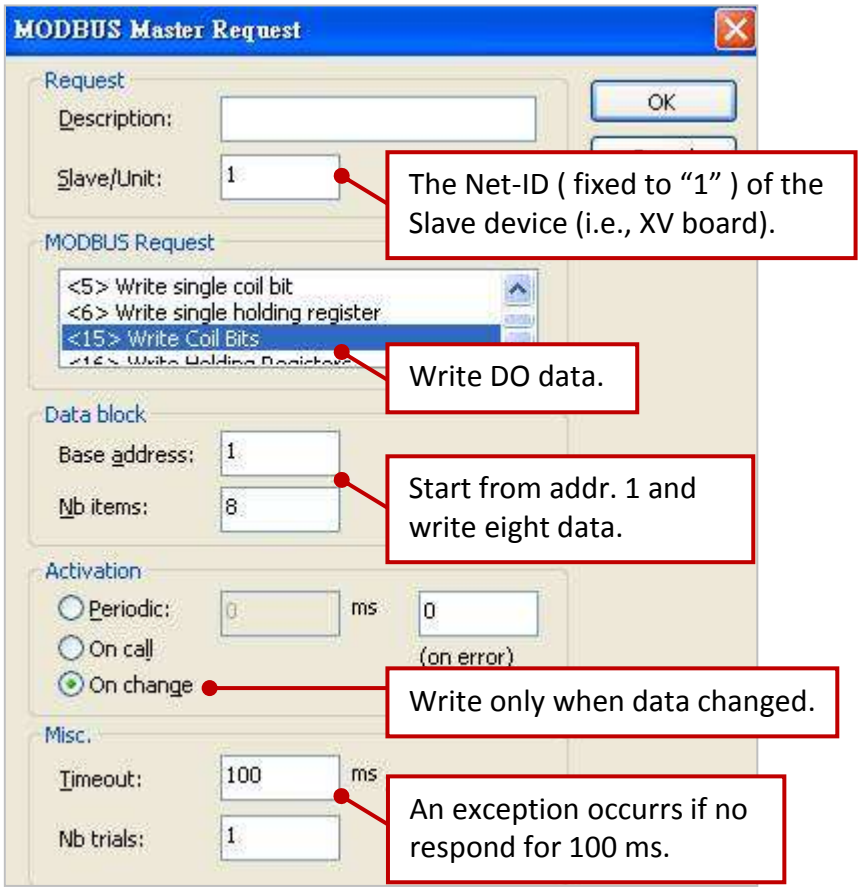


Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address). Moreover, if you set the "Operation" as "Error report", the "Offset" value for the mapping variable (Date Type: DINT) must set to "0".



2. Mouse double click the 2nd data block (i.e., <15> Write Coil Bits) to open the setting window.





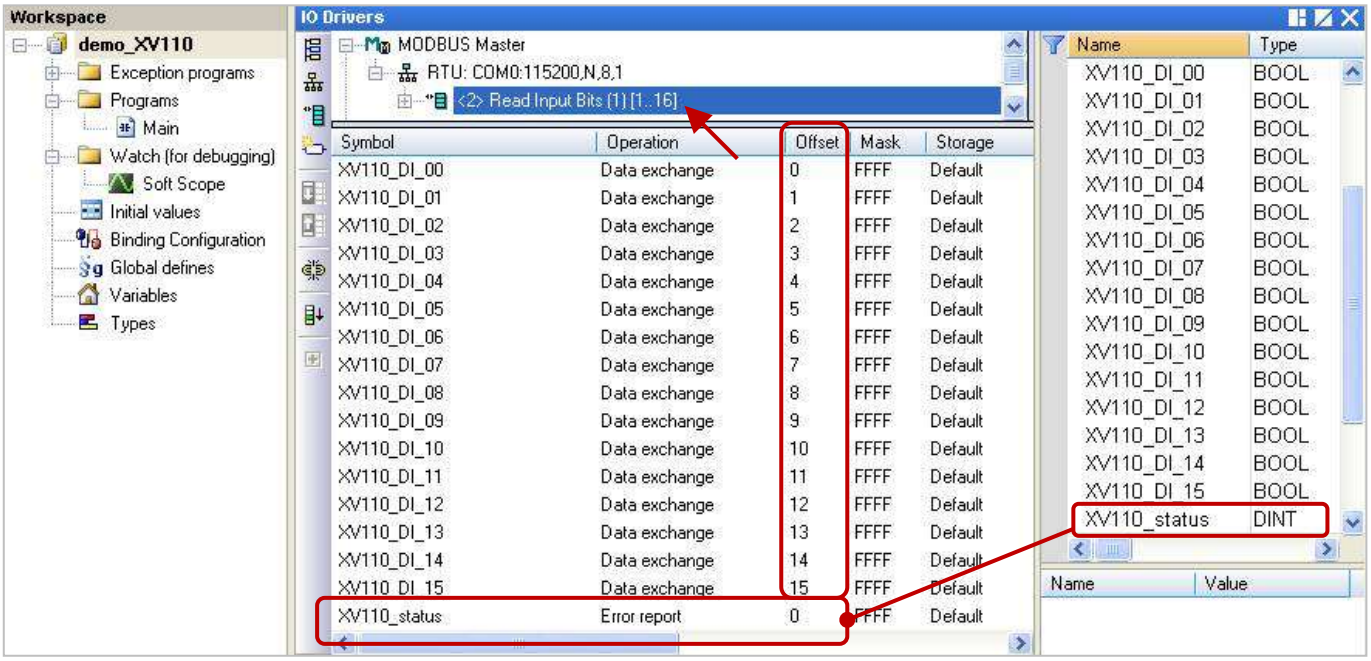
5.1.8 Connecting the XV110 (16 DI)

The XV110 is a 16-channel digital input board. This section provides a Win-GRAF demo project - "demo_XV110.zip". First, go to Section 5.1.6 for the information of the XV Board before using it.

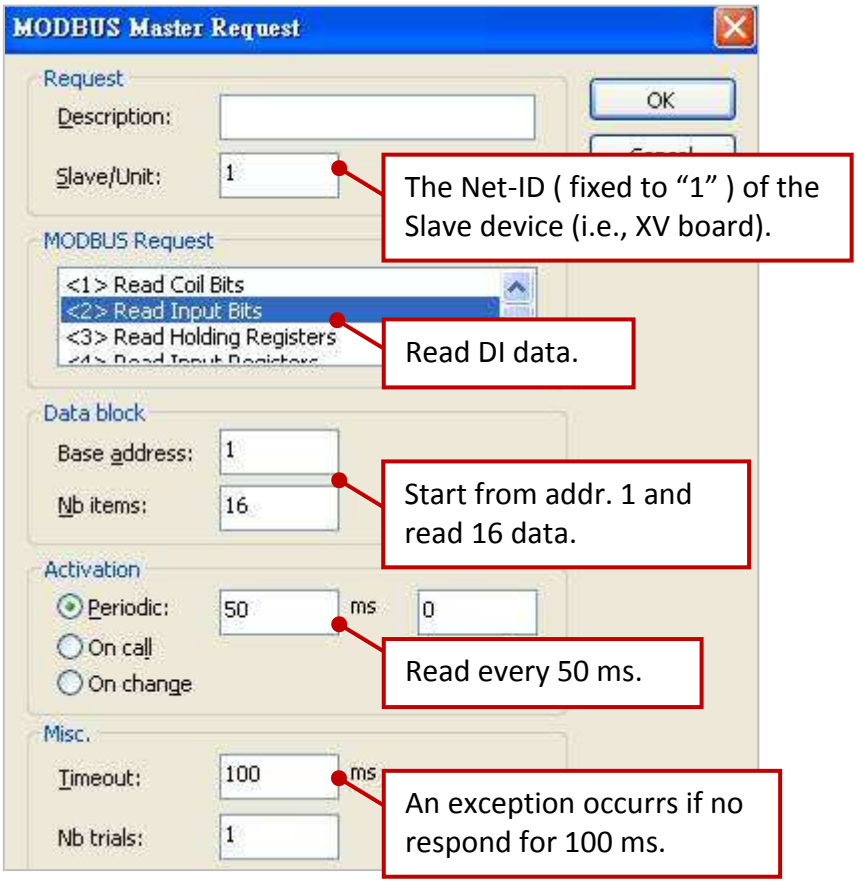
Demo description:

This demo added one data block that used to write 16 DI data.

1. Mouse double click "<2> Read Input Bits" to open the setting window.



Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address). Moreover, if you set the "Operation" as "Error report", the "Offset" value for the mapping variable (Date Type: DINT) must set to "0".



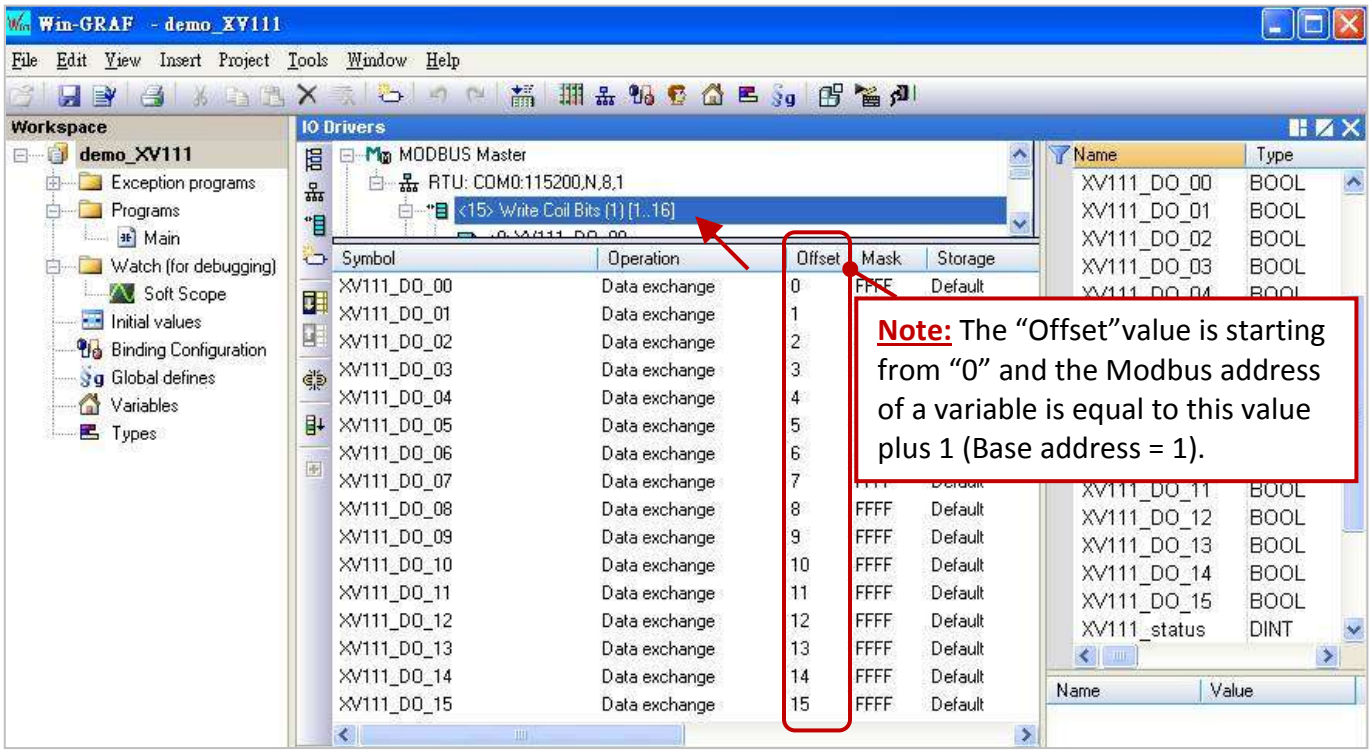
5.1.9 Connecting the XV111, XV111A (16 DO)

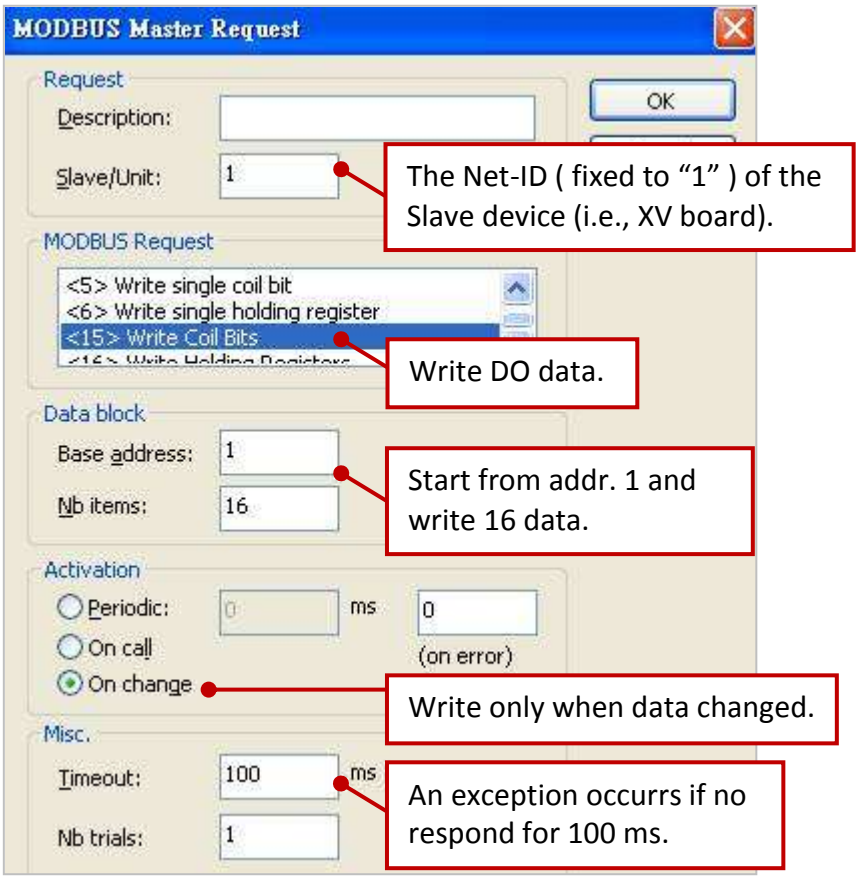
The XV111/ XV111A is a 16-channel digital output board. This section provides a Win-GRAF demo project - "demo_XV111.zip". First, go to Section 5.1.6 for the information of the XV Board before using it.

Demo description:

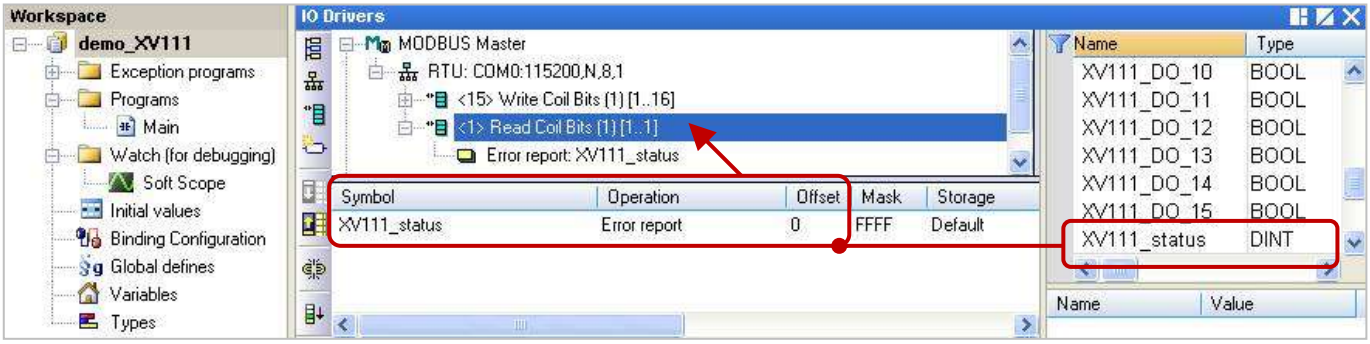
This demo added two data blocks. One is used to write 16 DO data and the other is used to read the DO status.

1. Mouse double click the 1st data block (i.e., <15> Write Coil Bits) to open the setting window.

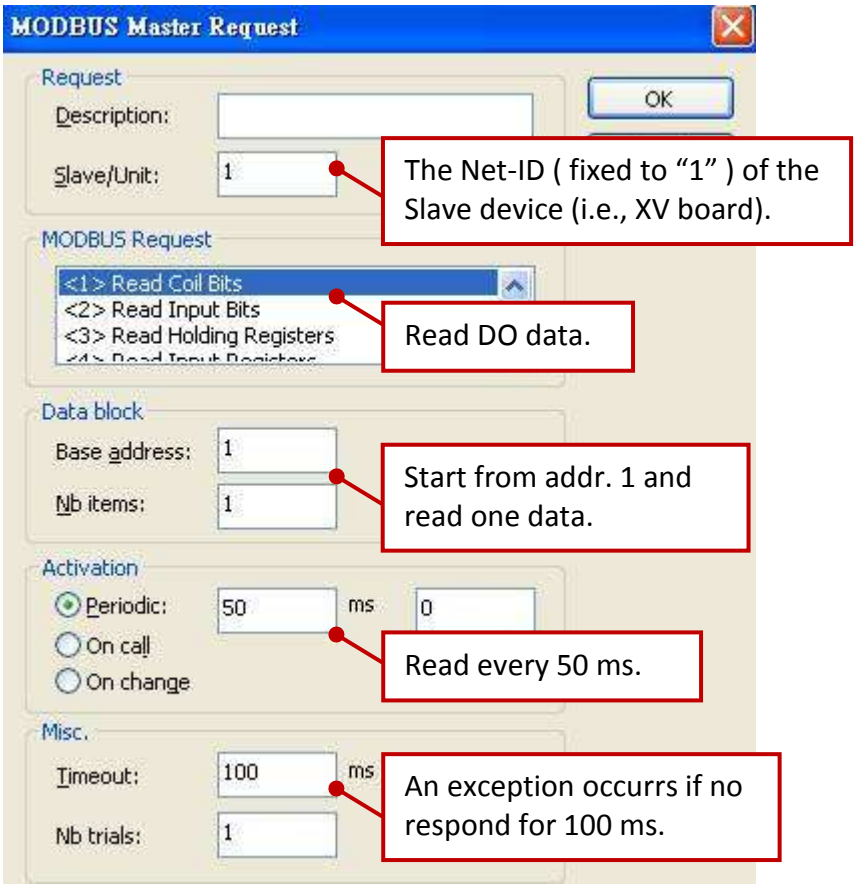




2. Mouse double click the 2nd data block (i.e., <1> Read Coil Bits) to open the setting window.



Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address).



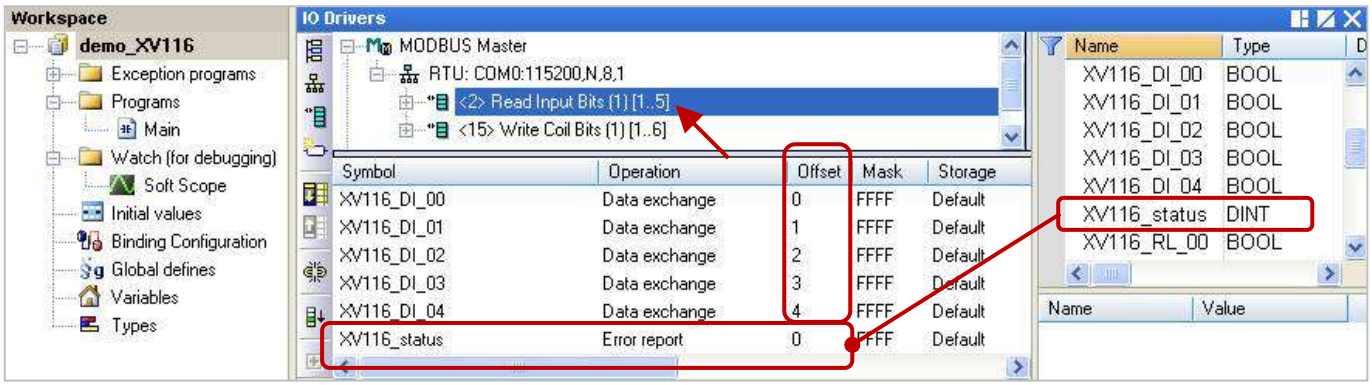
5.1.10 Connecting the XV116 (5 DI, 6 Relay)

The XV116 is a 5-channel digital input and 6-channel relay output board. This section provides a Win-GRAF demo project - "demo_XV116.zip". First, go to Section 5.1.6 for the information of the XV Board before using it.

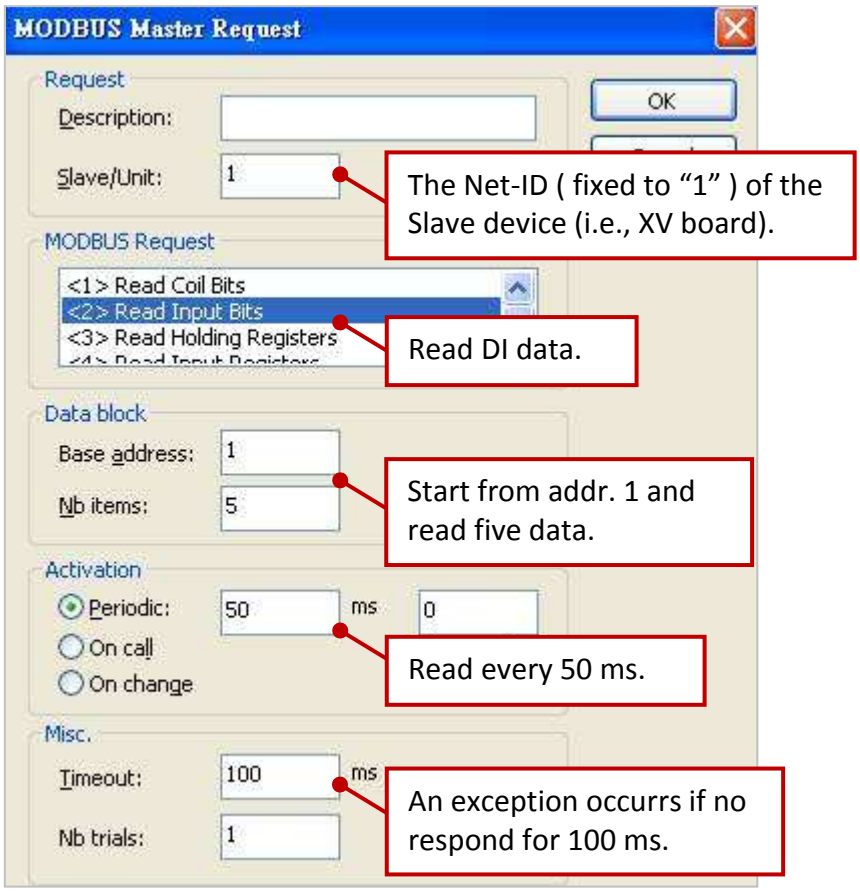
Demo description:

This demo added two data blocks. One is used to read 5 DI data and the other is used to write 6 DO data.

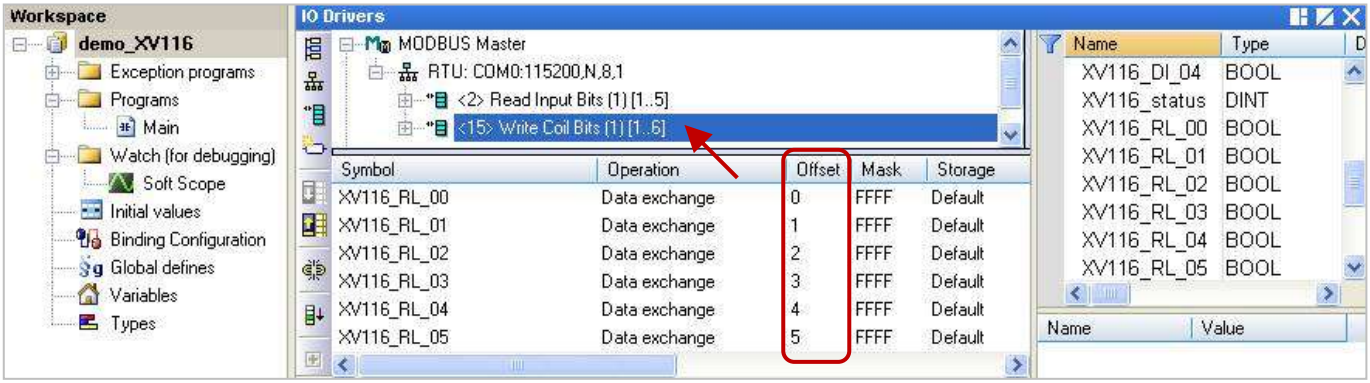
1. Mouse double click the 1st data block (i.e., <2> Read Input Bits) to open the setting window.

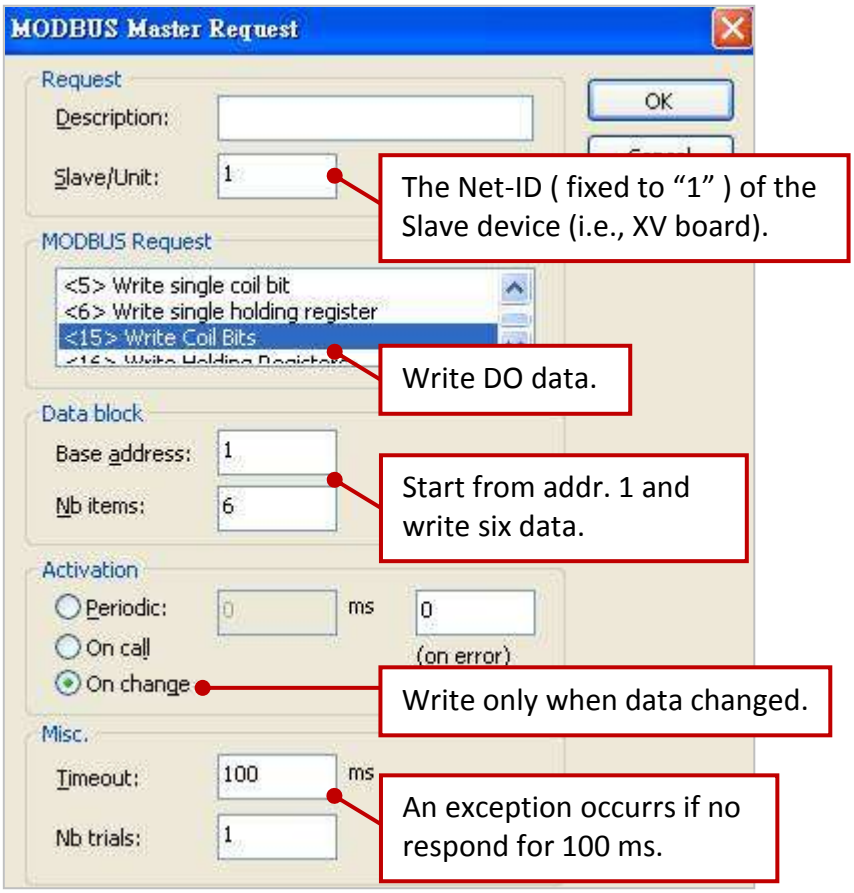


Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address). Moreover, if you set the "Operation" as "Error report", the "Offset" value for the mapping variable (Date Type: DINT) must set to "0".



2. Mouse double click the 2nd data block (i.e., <15> Write Coil Bits) to open the setting window.





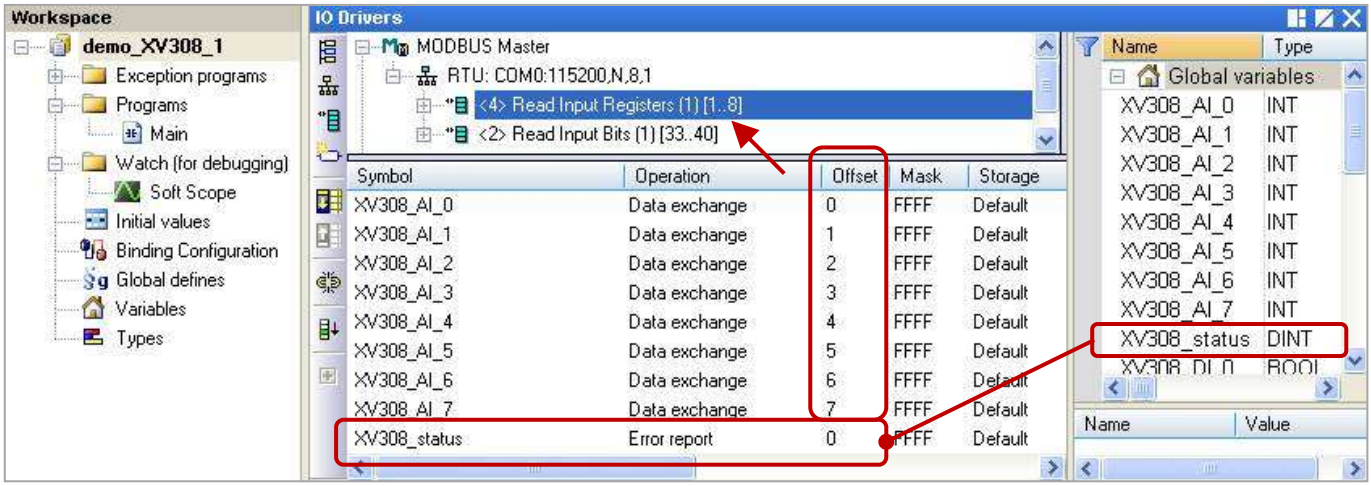
5.1.11 Connecting the XV308 (8 AI, 8 DIO)

The XV308 is a 8-channel analog input and 8-channel digital input/output board. This section provides three Win-GRAF demo projects - "demo_XV308_1.zip", "demo_XV308_2.zip" and "demo_XV308_3.zip". First, go to Section 5.1.6 to view the XV Board instructions and then configure each AI channel by using "DCON_Utility_Pro_CE_200.exe".

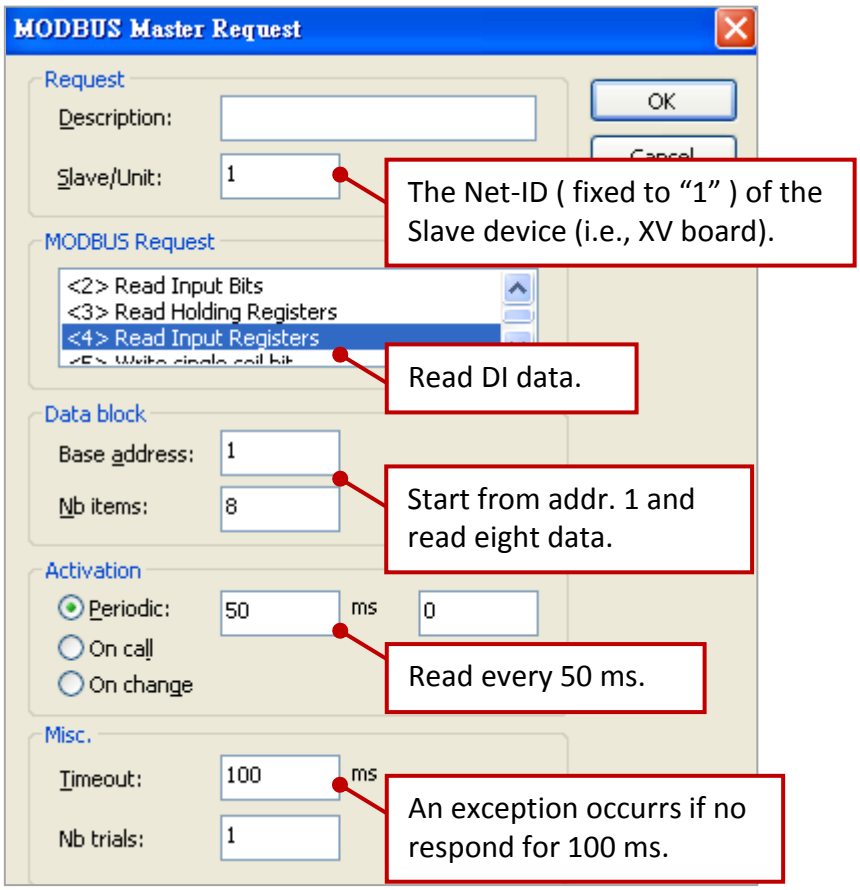
Demo description: (demo_XV308_1)

This demo added two data blocks, one is used to read 8 AI data and the other is used to write 8 DI data.

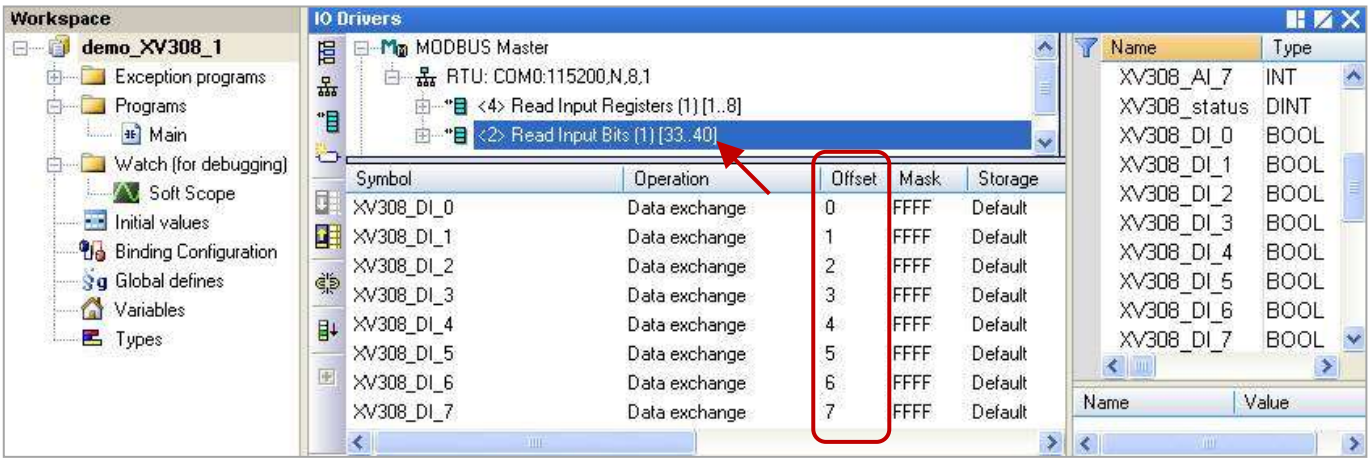
1. Mouse double click the 1st data block (i.e., <4> Read Input Registers) to open the setting window.



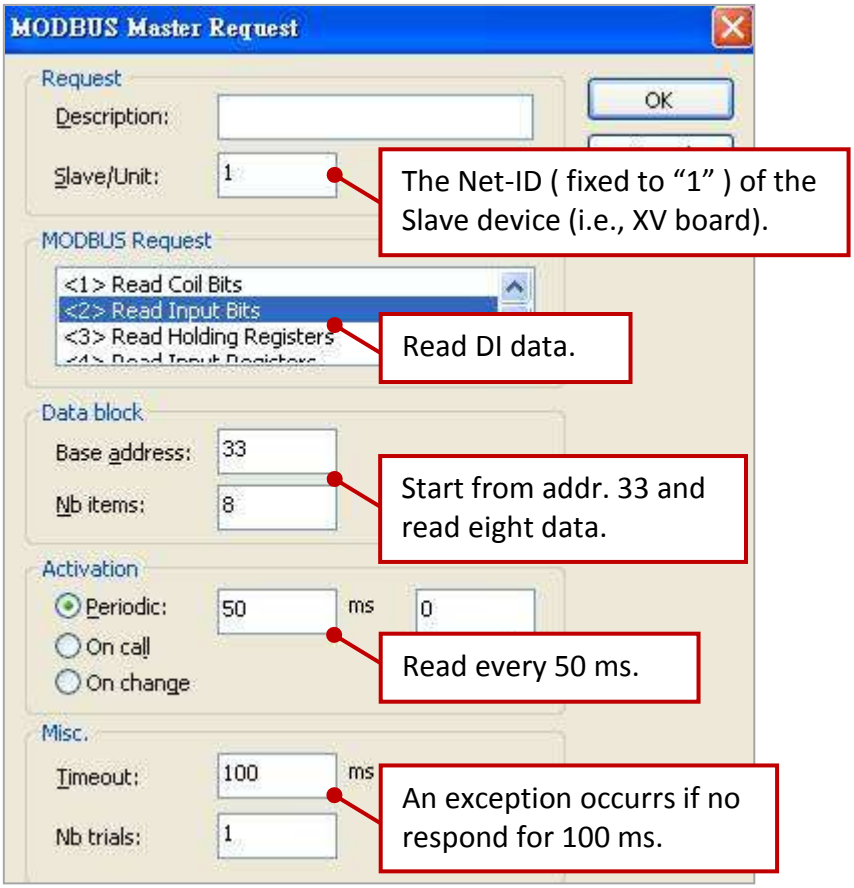
Note: The “Offset” value is starting from “0” and the Modbus address for variables is equal to the “Offset” value plus 1 (Base address). Moreover, if you set the “Operation” as "Error report”, the “Offset” value for the mapping variable (Date Type: DINT) must set to “0”.



2. Mouse double click the 2nd data block (i.e., <2> Read Input Bits) to open the setting window.



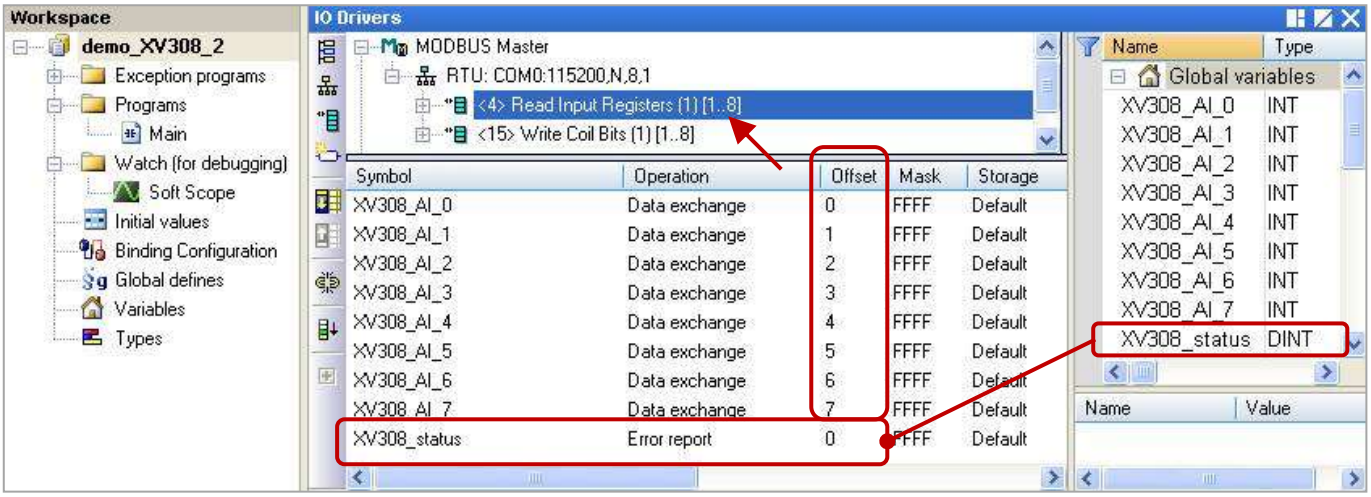
Notw: When using the XV308 to read DI data, the address must start from "33".



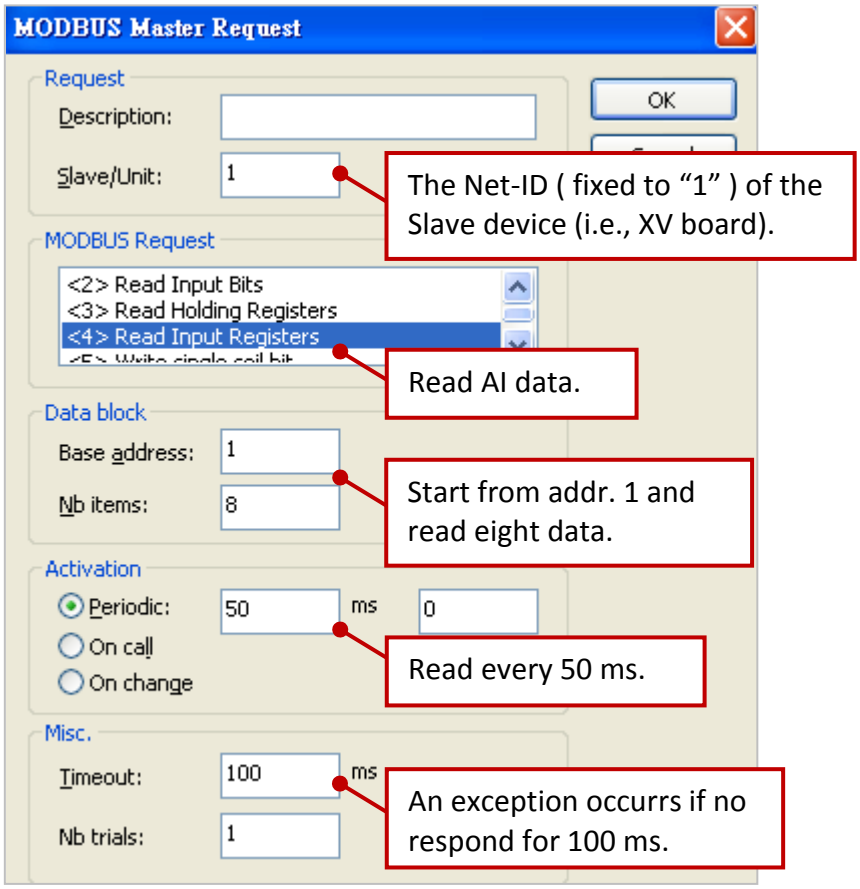
Demo description: (demo_XV308_2)

This demo added two data blocks, one is used to read 8 AI data and the other is used to write 8 DO data.

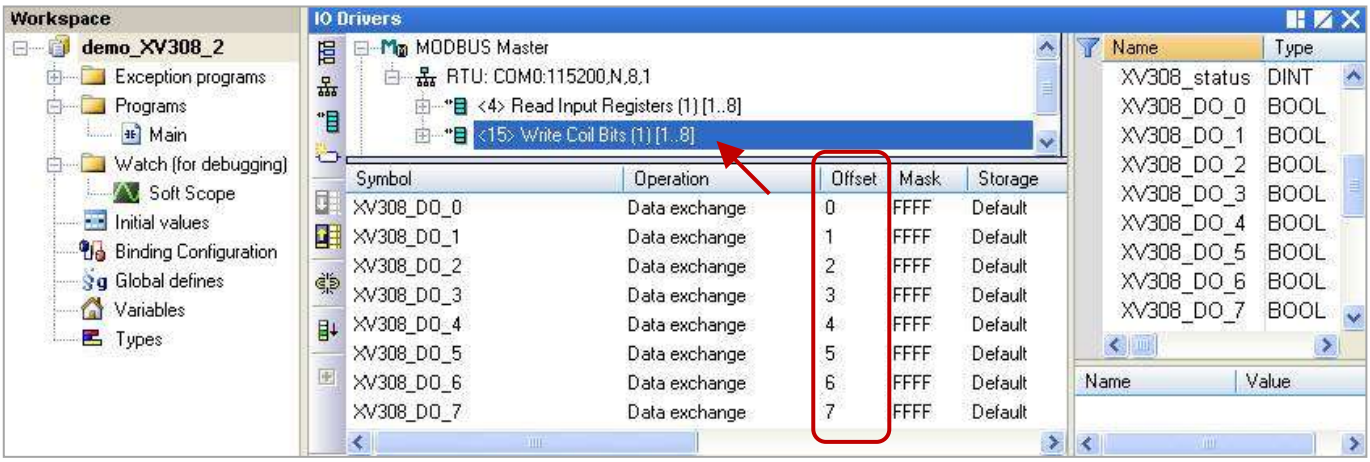
1. Mouse double click the 1st data block (i.e., <4> Read Input Registers) to open the setting window.

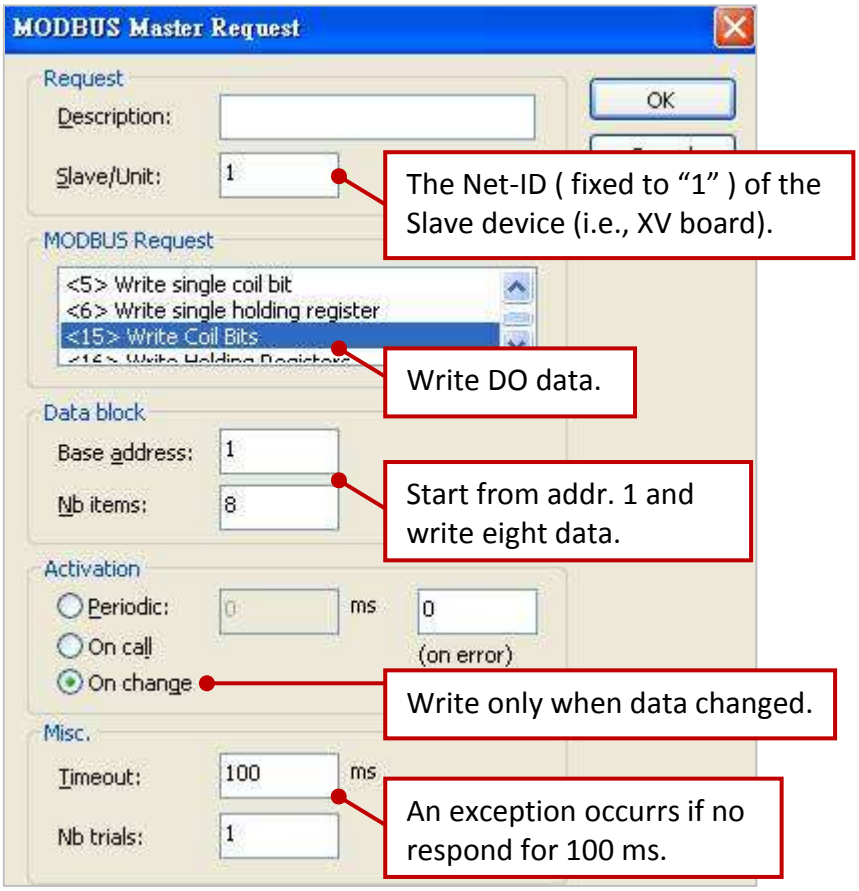


Note: The “Offset” value is starting from “0” and the Modbus address for variables is equal to the “Offset” value plus 1 (Base address). Moreover, if you set the “Operation” as "Error report”, the “Offset” value for the mapping variable (Date Type: DINT) must set to “0”.



2. Mouse double click the 2nd data block (i.e., <15> Write Coil Bits) to open the setting window.

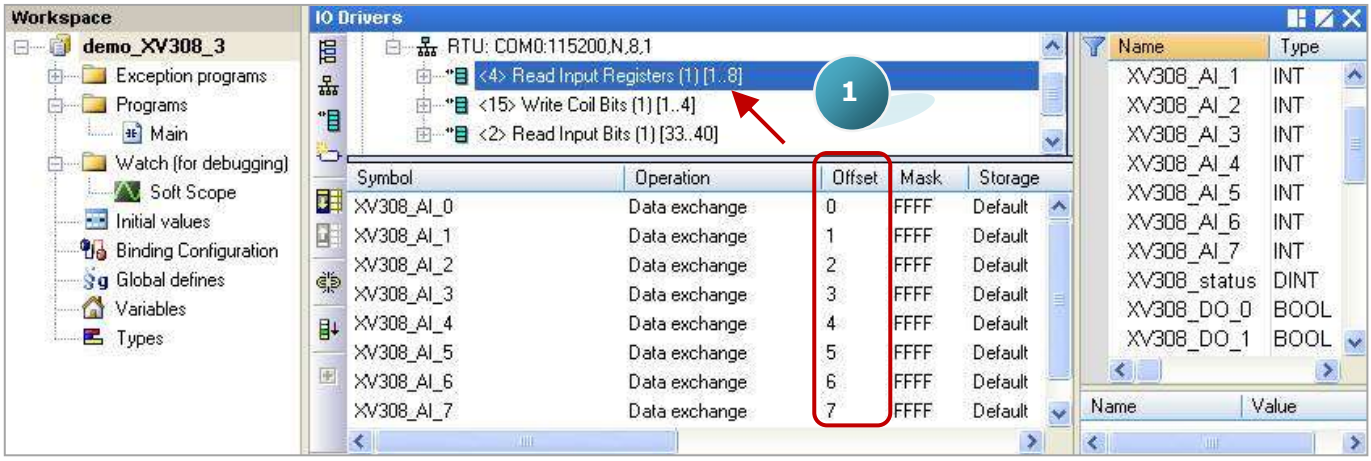




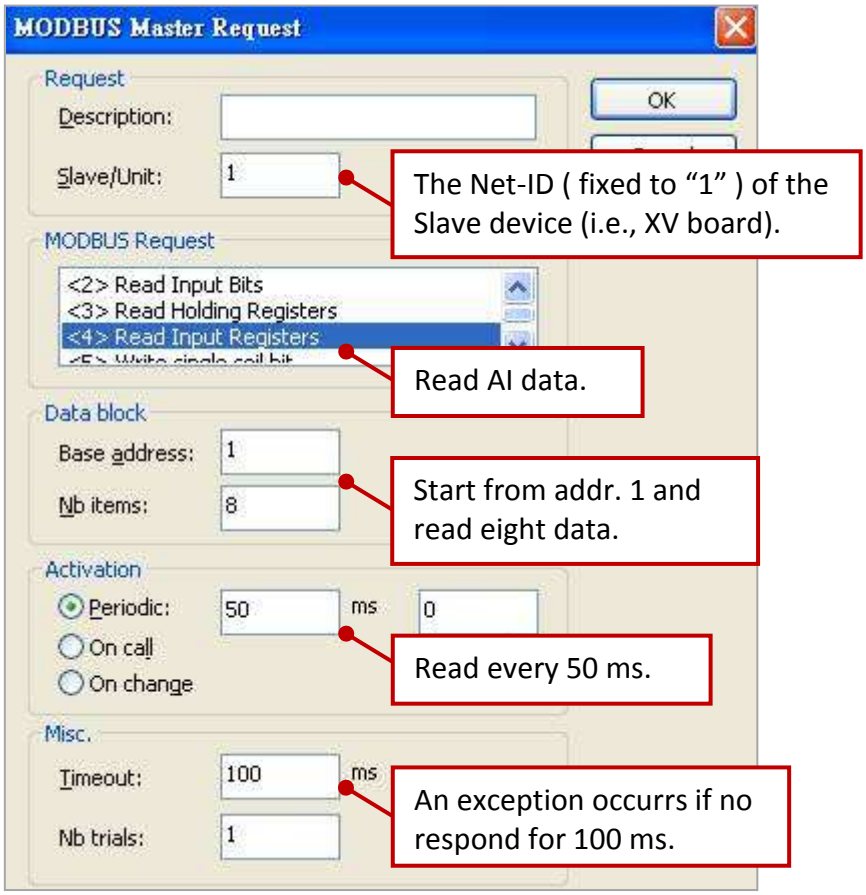
Demo description: (demo_XV308_3)

This demo added three data blocks, the 1st one is used to read 8 AI data, the 2nd one is used to write 4 DO data and the 3rd one is used to read only 4 DI data.

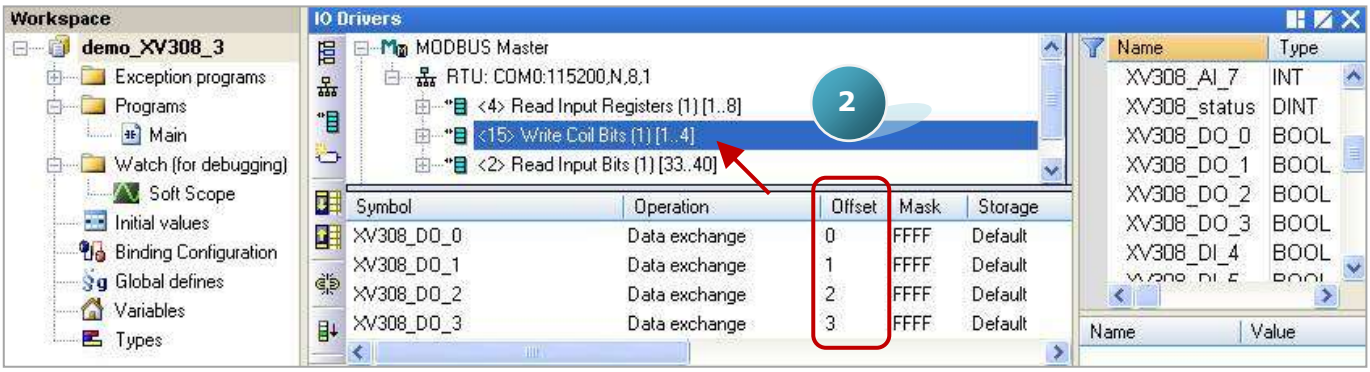
1. Mouse double click the 1st data block (i.e., <4> Read Input Registers) to open the setting window.

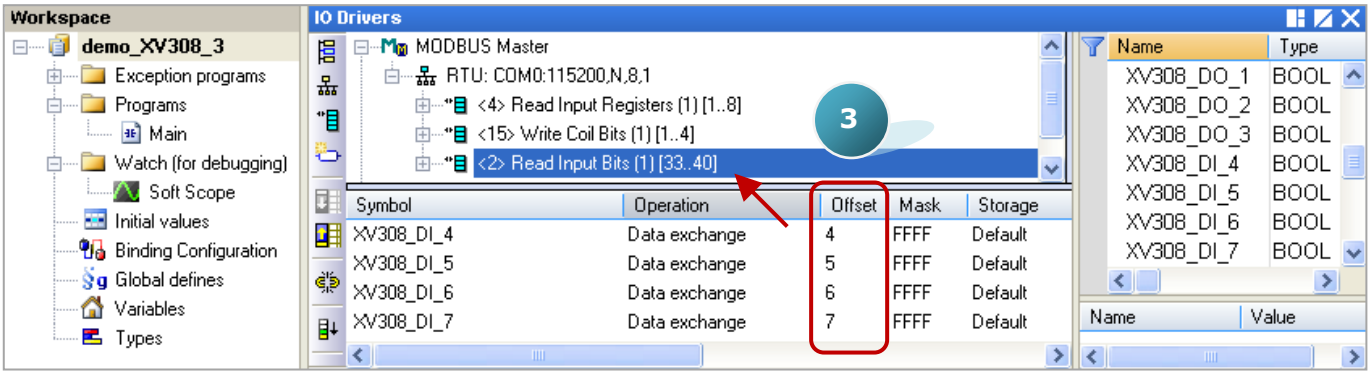


Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address).

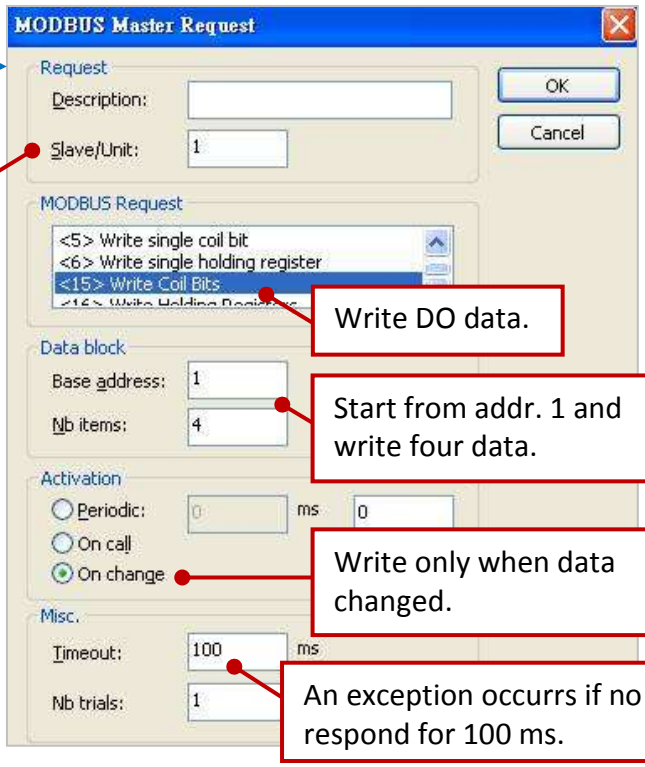


2. As the figure below, mouse double click the 2nd data block (i.e., <15> Write Coil Bits) to view the setting window.
3. As the figure below, mouse double click the 3rd data block (i.e., <2> Read Input Bits) to view the setting window.





2. <15> Write Coil Bits: Write 4 DO data.



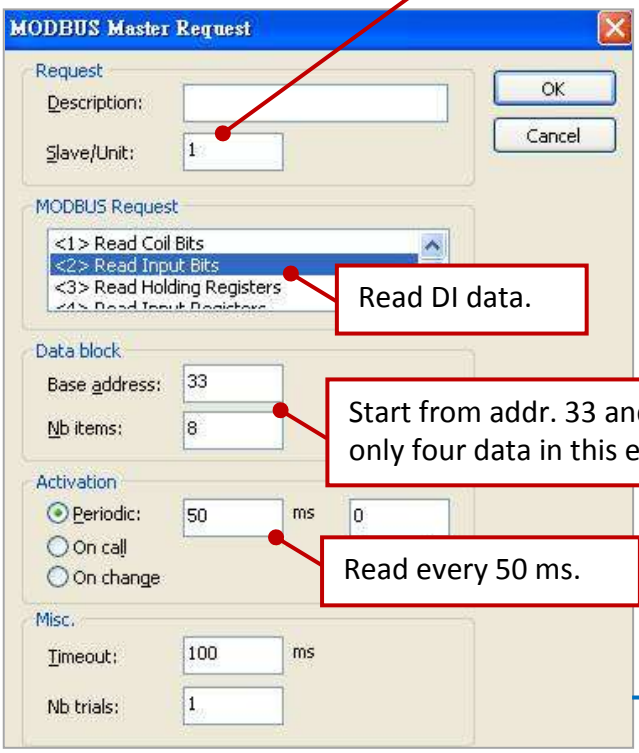
The Net-ID (fixed to “1”) of the Slave device (i.e., XV board).

Write DO data.

Start from addr. 1 and write four data.

Write only when data changed.

An exception occurrs if no respond for 100 ms.



Read DI data.

Start from addr. 33 and read only four data in this example.

Read every 50 ms.

3. <2> Read Input Bits, read 4 DI data.

Note:

When using the XV308 to read DI data, the address must start from "33".

5.1.12 Connecting the XV310 (4 AI, 2 AO, 4 DI, 4 DO)

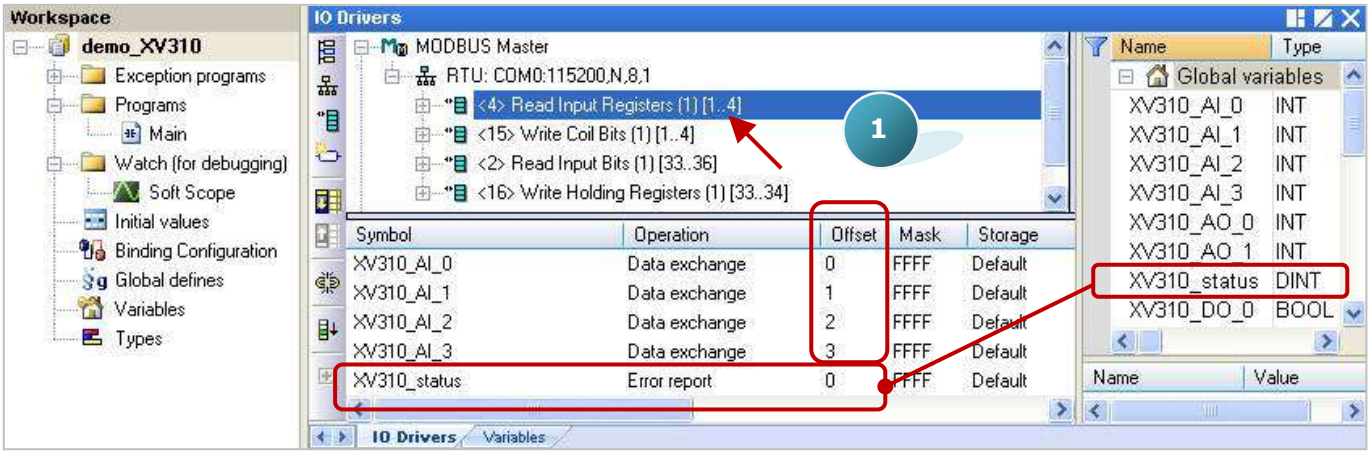
The XV310 is a 4-ch analog input, 2-ch analog output, 4-ch digital input and 4-ch digital ouput board. This section provides a Win-GRAF demo projects - "demo_XV310.zip".

First, go to Section 5.1.6 to view the XV Board instructions and then configure each AI channel by using "DCON_Utility_Pro_CE_200.exe".

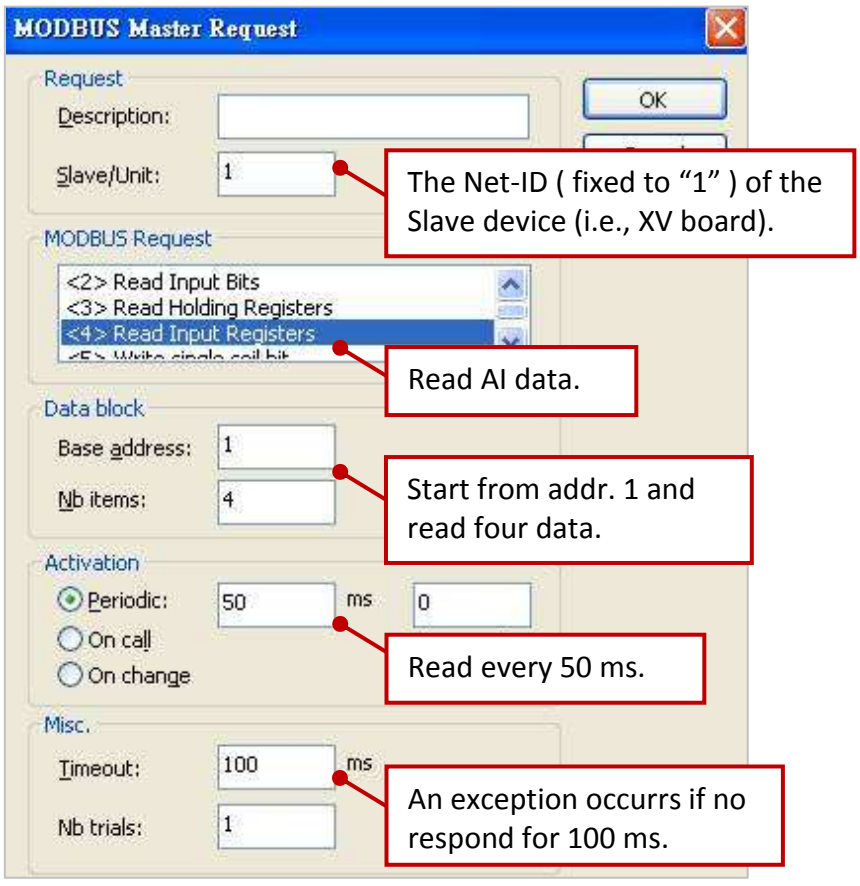
Demo Description

This demo added four data blocks. The 1st one is used to read 4 AI data, the 2nd is used to write 4 DO data, the 3rd is used to read 4 DI data and the 4th is used to write 2 AO data.

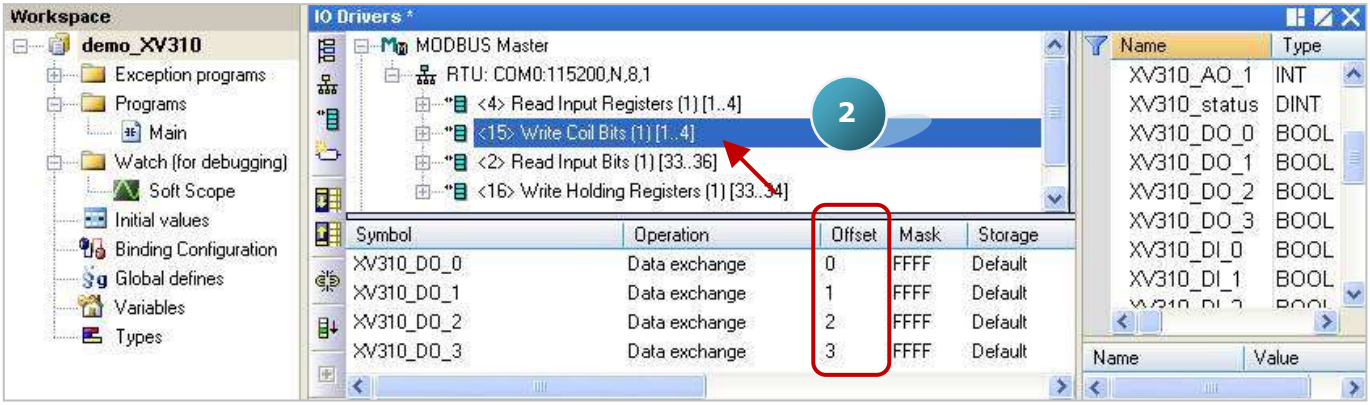
1. Mouse double click the 1st data block (i.e., <4> Read Input Registers) to open the setting window.

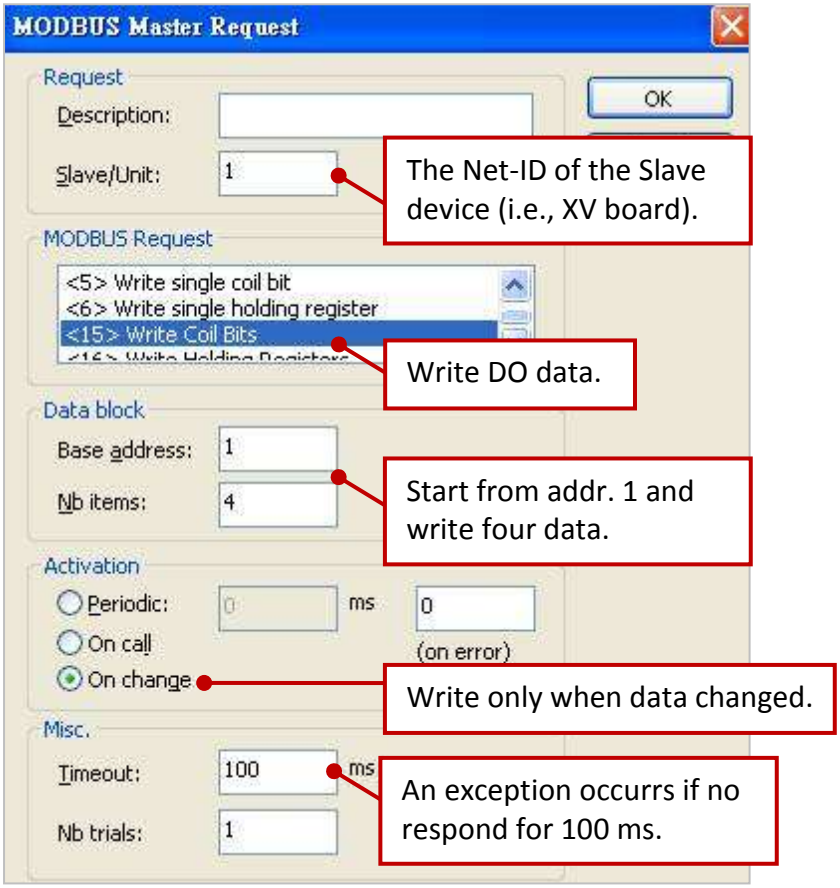


Note: The "Offset" value is starting from "0" and the Modbus address for variables is equal to the "Offset" value plus 1 (Base address). Moreover, if you set the "Operation" as "Error report", the "Offset" value for the mapping variable (Date Type: DINT) must be set to "0".

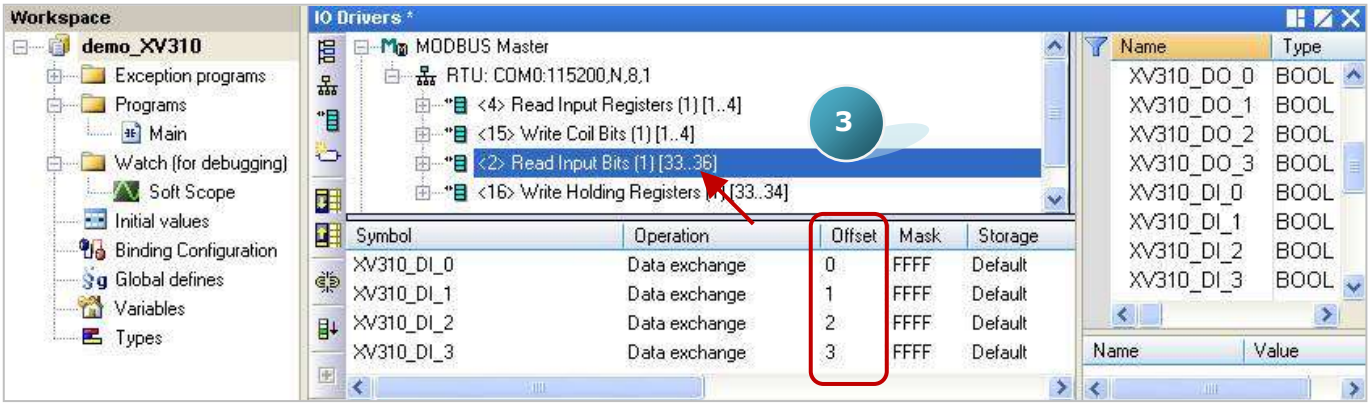


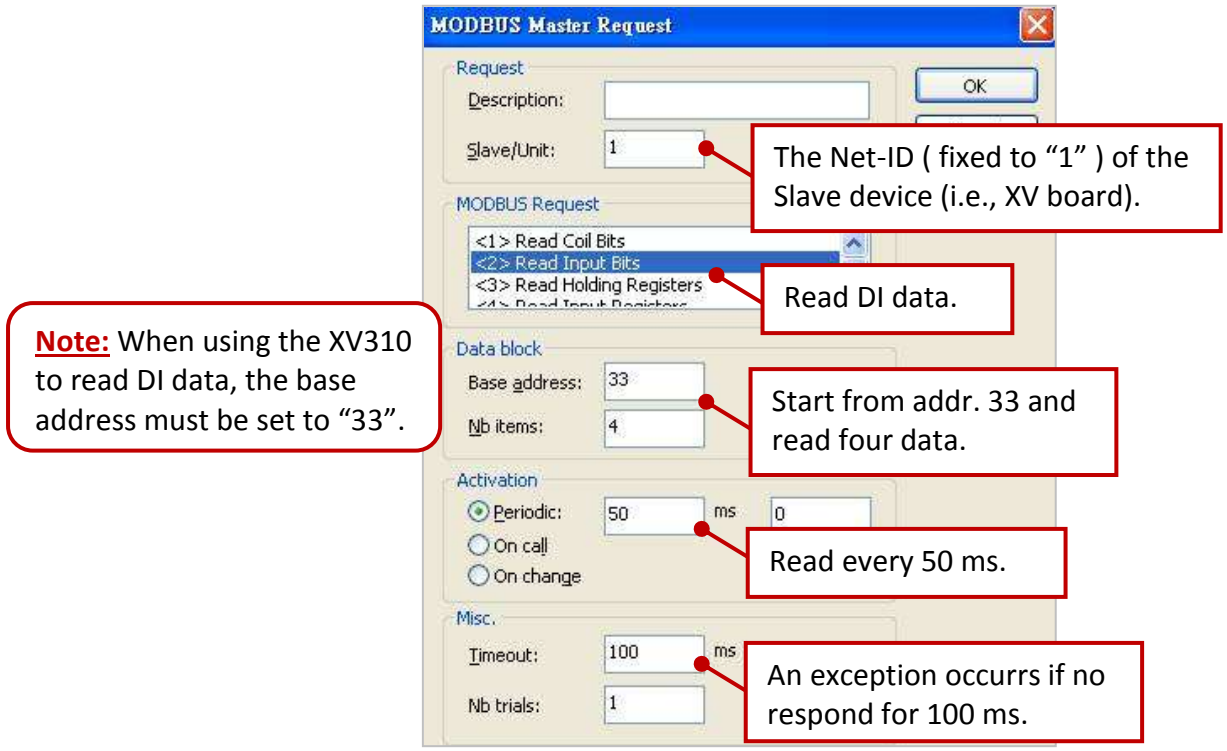
2. Mouse double click the 2nd data block (i.e., <15> Write Coil Bits) to view the setting window.



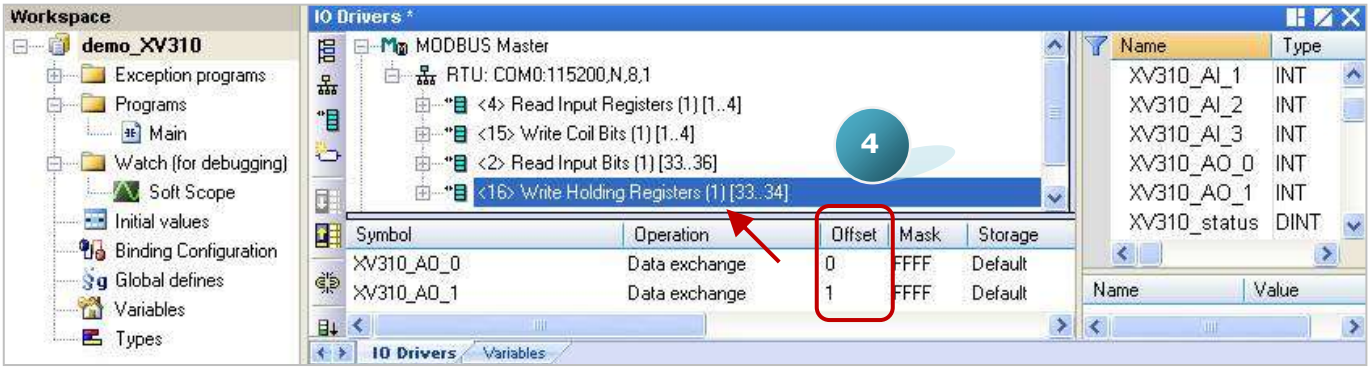


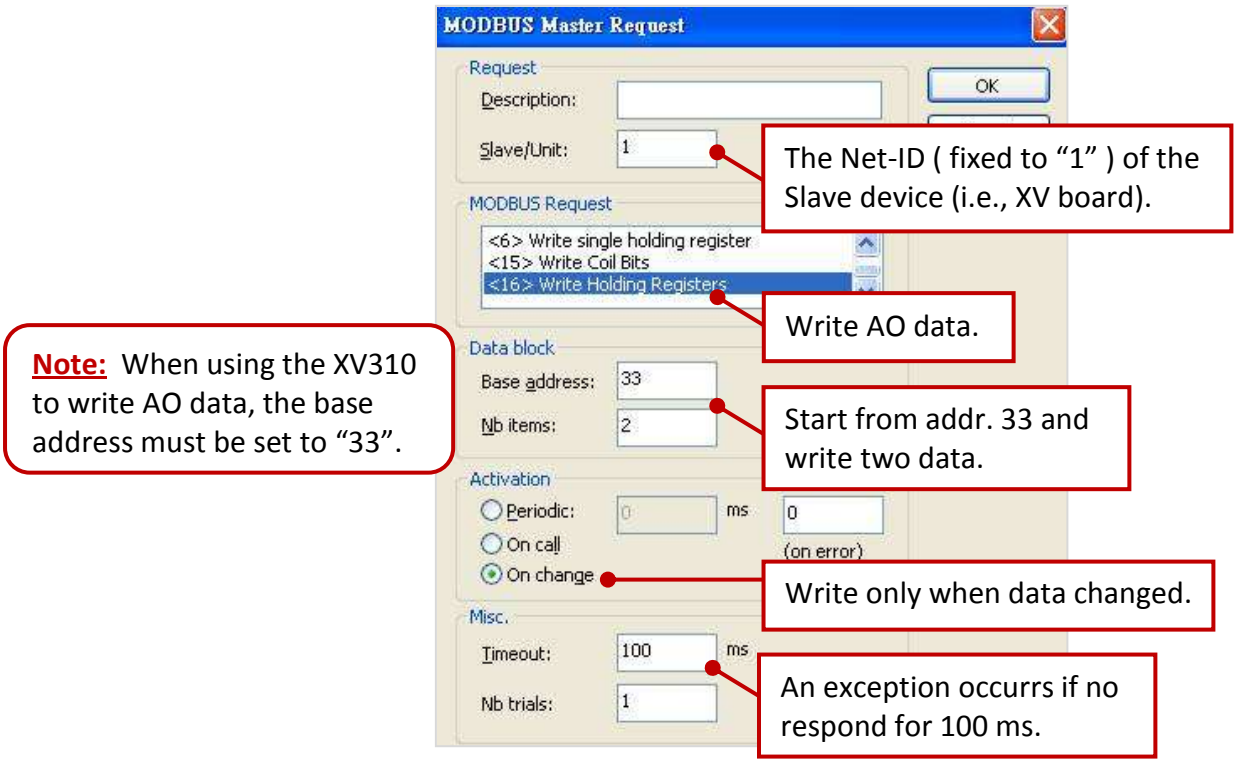
3. Mouse double click the 3rd data block (i.e., <2> Read Input Bits) to view the setting window.





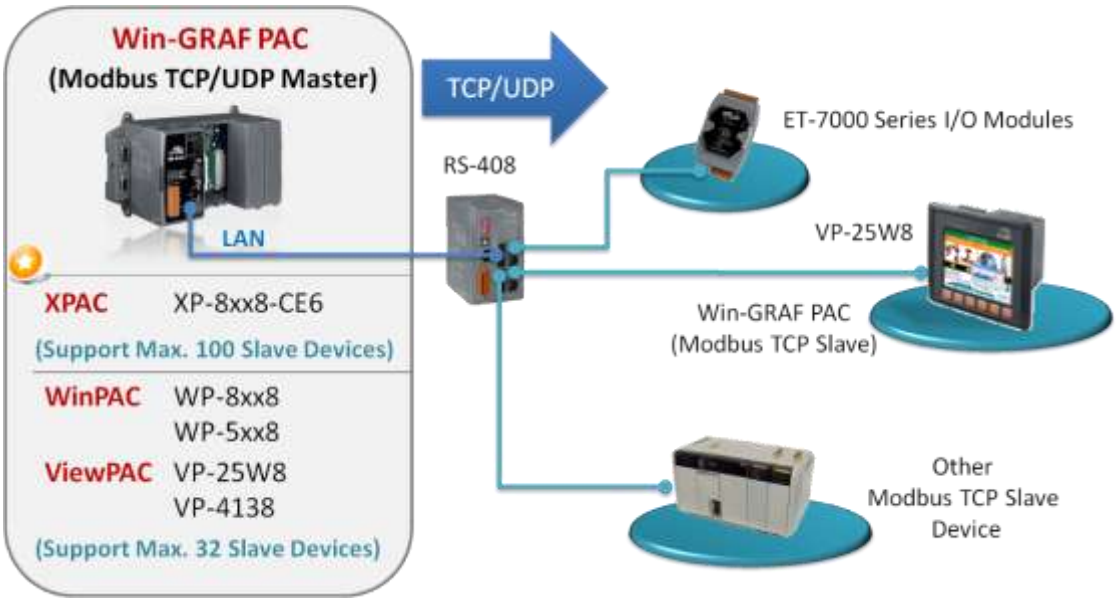
4. Mouse double click the 4th data block (i.e., <16> Write Holding Registers)





5.2 Enabling the Win-GRAF PAC as a Modbus TCP/UDP Master

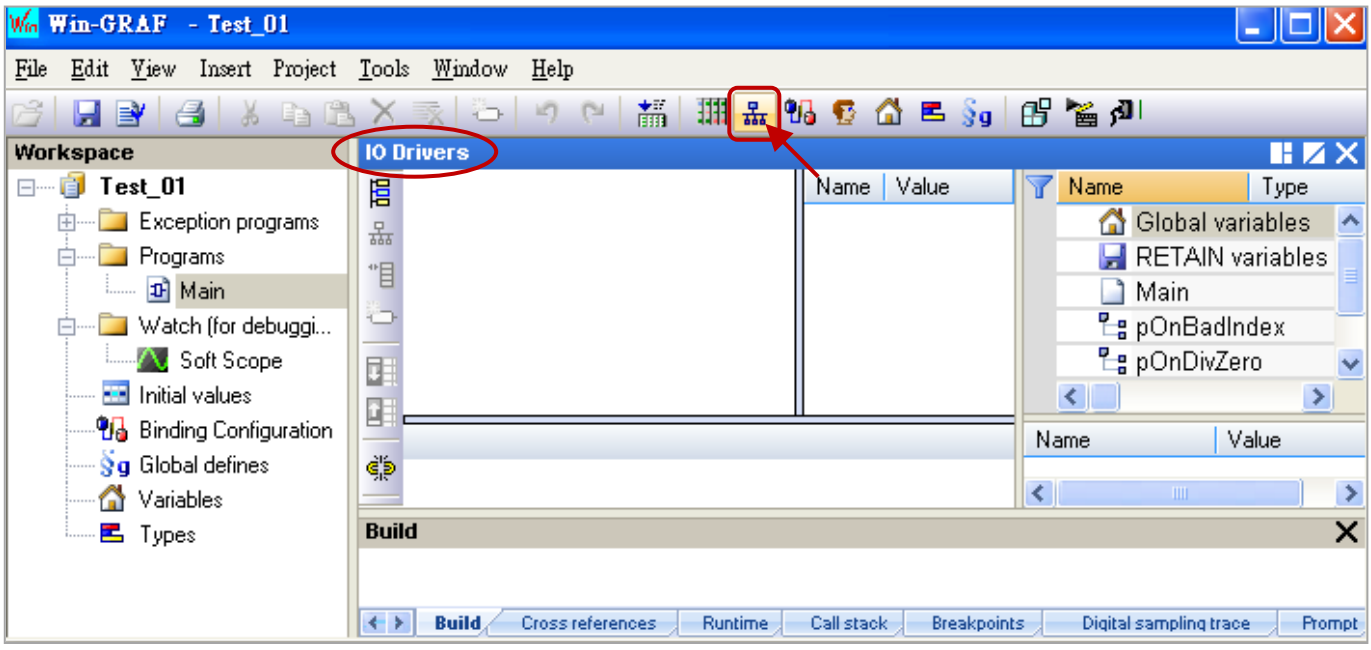
Application Diagram:



(Refer P1-1 to see the PAC model numbers.)

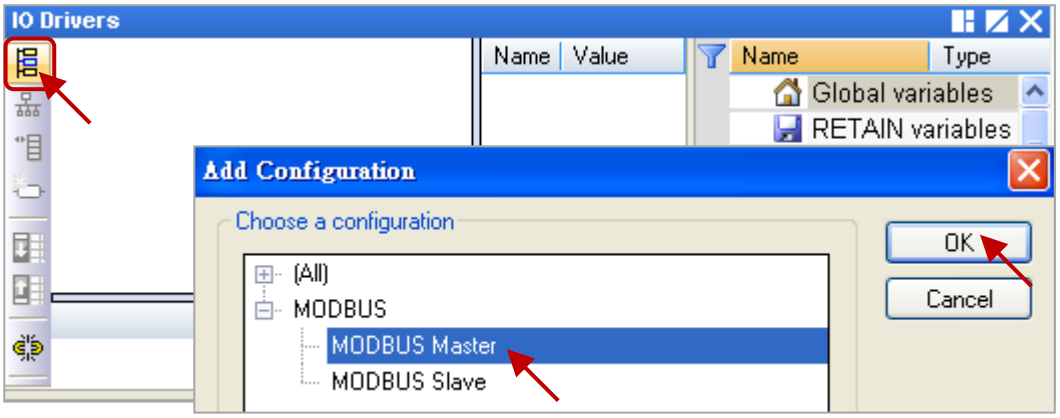
The Setting Steps:

1. Click the tool icon "Open Fieldbus Configuration" to open the "I/O Drivers" window.

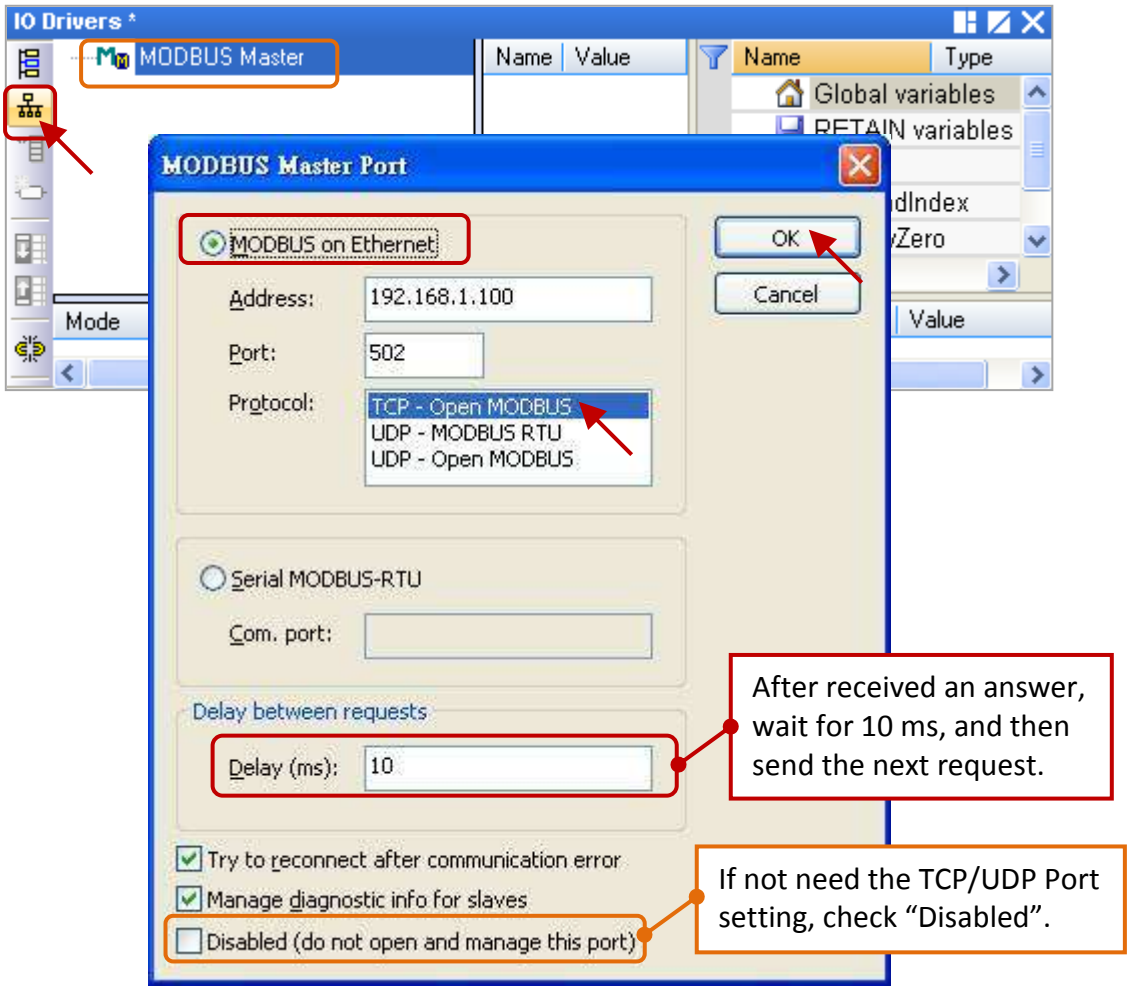


2. Click "Insert Configuration" icon in the left side of the "I/O Drivers" window, and then click "MOSBUS Master", then click "OK" to enable a Modbus Master.

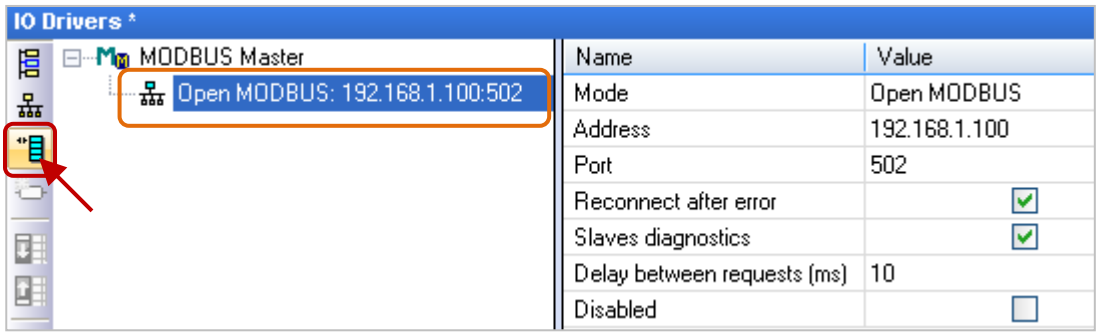
   Note: One "Modbus Master" can set up multiple Ports (see the next step), can set as a Modbus Master RTU/ASCII Port (Refer Section 5.1) or a Modbus Master TCP/UDP Port or can set up not to enable the setting.



3. Click the tool icon “Insert Master/Port” in the left side, open the setting window and select the “MODBUS on Ethernet”.
   Set up the following items, and then click “OK”.
   - Address: Fill in the IP Address of the Modbus Slave device (e.g., “192.168.1.100”).
   - Port: TCP port Number of the Slave device.
   - Protocol: If as a Modbus TCP Master, select the “TCP – Open MODBUS”.
     If as a Modbus UDP Master, choose the “UDP – Open MODBUS”.
   - Delay: Fill in the delay time (e.g., 10 ms, can be 0 ~ 10000).

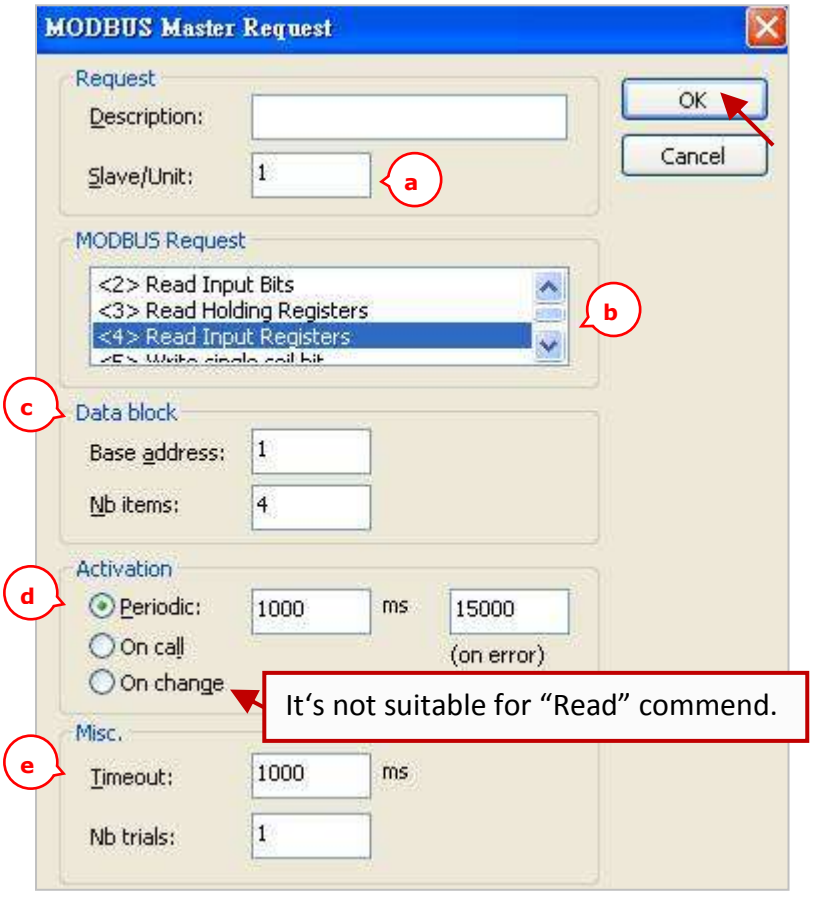


4. Click the icon “Insert Slave/Data Block” in the left side to create a “Data Block”.



Read AI Data

5. In the “MODBUS Master Request” setting window, set up the following items, and then click “OK".



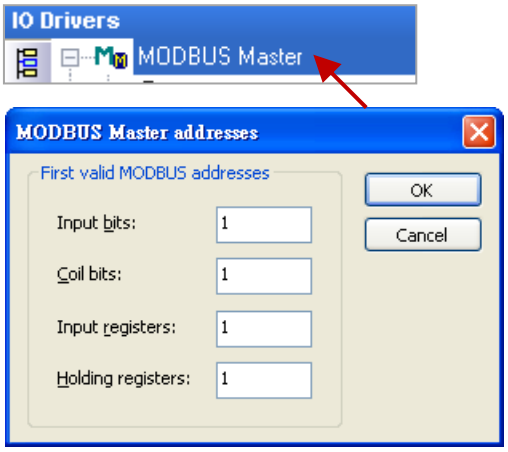
In this example

a. Slave/Unit:
Fill in the Net-ID of the Slave device (Usually is “1”).

b. MODBUS Request:
Select “<4> Read Input Registers”.

c. Base address:
Default to start from 1.
Nb items:
The AI numbers to read (here is 4).

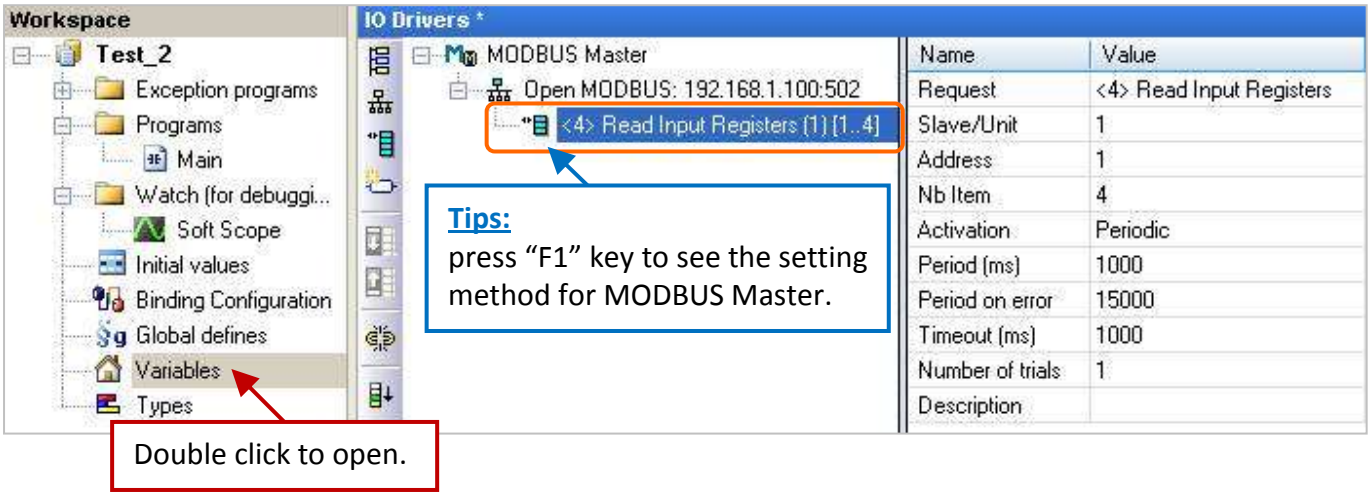
Note:
If want to change the “Base address”, please use mouse to right-click the “MODBUS Master”, and then select “MODBUS Master Addresses” to change the value.



d. Activation: the sending way of Modbus Request.
Periodic: Send request periodically. In this case, it sends request every 1 Sec. “on error” means that when an error occurs, the next sending time (in this case, 15 seconds).
On call: It will send the request once when a program calls it.
On change: It will send the request once when data is changed.

e. Timeout: Set up the max. time to wait for the response. If exceeds it, that means an error. (For Modbus TCP/UDP, recommended: 1000 ~ 3000 ms; this example is 1000 ms)

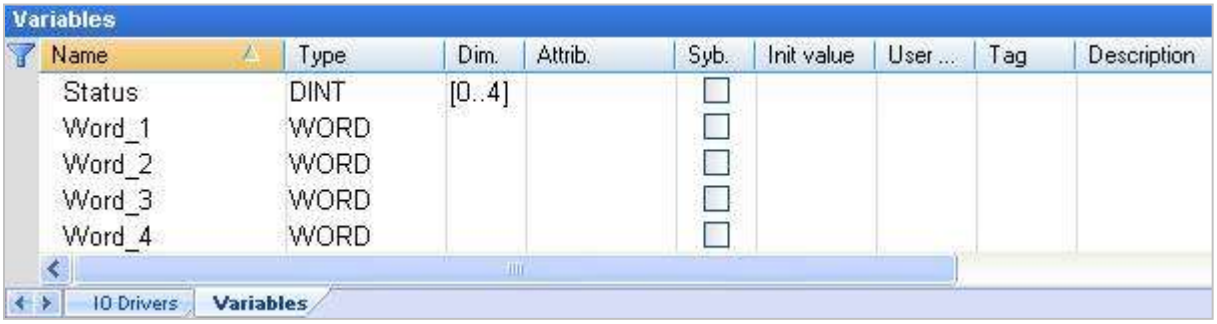
6. Open the “Variables” window, set up the variables want to use.



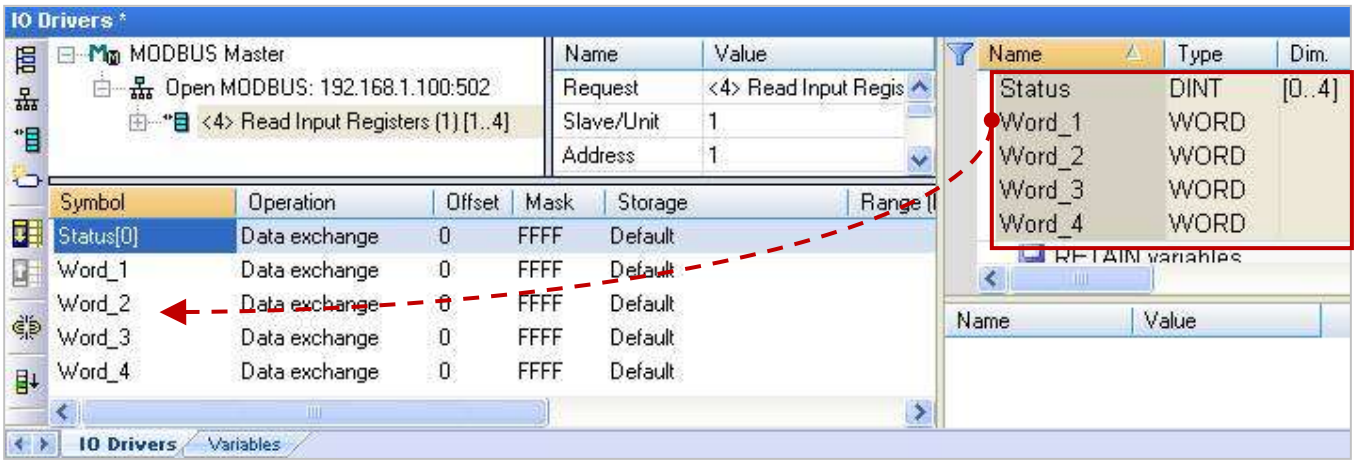
Please follow the table to set up 4 WORD (16 bit) variables (refer Section 2.3.1).

Variable Name	Data Type	Dim.	Description
Word_1 ~ Word_4	WORD	---	Used to read the AI data (16 bit)
Status	DINT	5	Used to record the read/write status

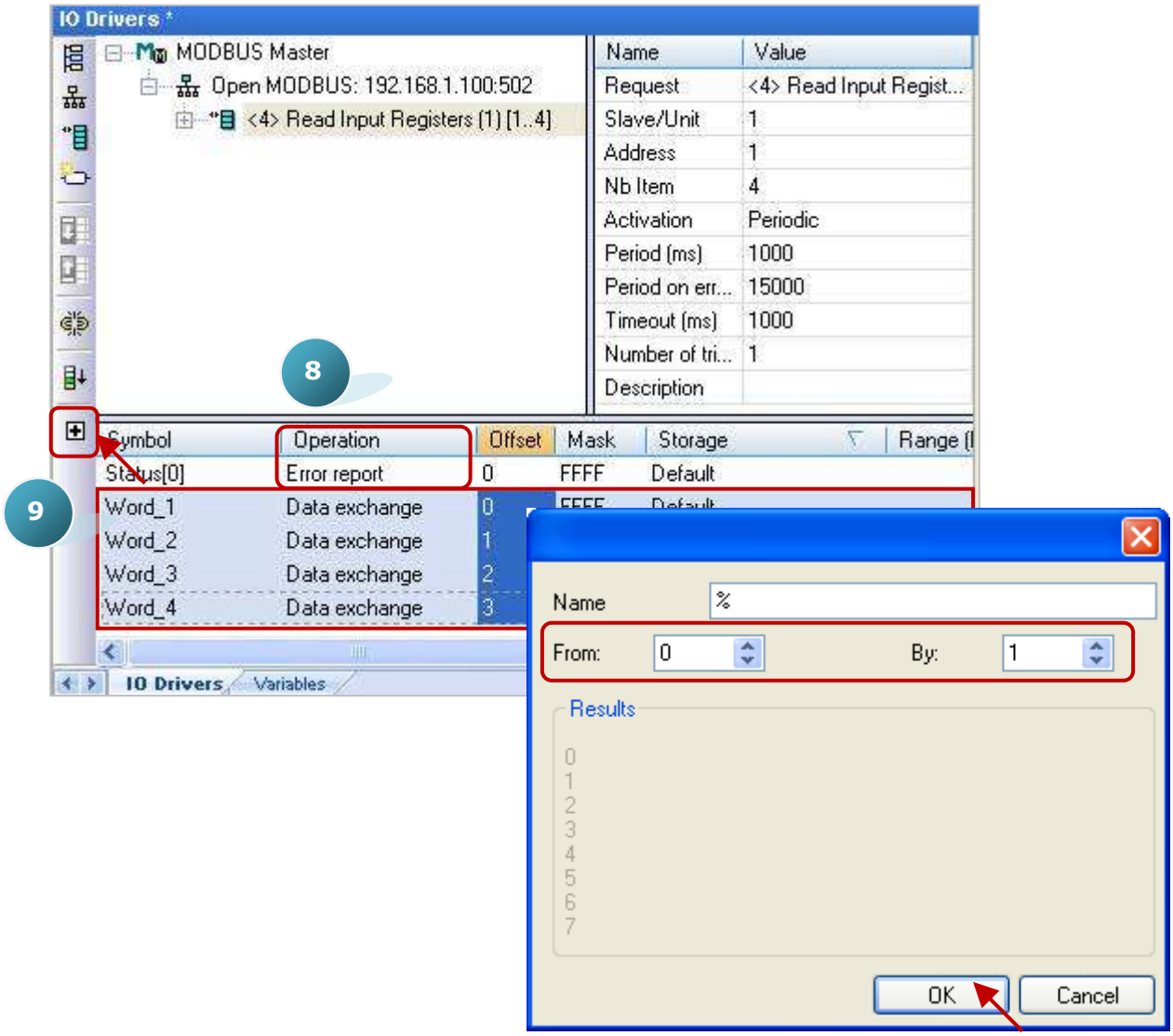
Refer the Appendix A to see the data types and range of the variables. After setting up, it is as the picture below.



7. In the “I/O Drivers” window, drag the variables (“Word_1 ~ Word_4” and “Status”) from the Variables area to the “Symbol” area of the Data Block. **Notice:** This example shows “Status” is an Array variable. When drag it to the “Symbol” area, it will become “Status[0] ~ Status[4]", please press “Delete” key to delete “Status[1] ~ [4]".



8. Set the “Operation” of the “Status[0]” to “Error report” (If reading data fails, its value is an “Error Code”; when reading data OK, it will reset to “0”.). Press “F1” key to view the setting descriptions for the Modbus Master. In the title of “Status and command variables”, you can find the details about this commend and “Error Code”.
9. Select "Word_1 ~ Word_4” and click “Iterate property” to set up the “Offset” value (From: 0; By: 1).



The setting steps of “Modbus Master Request” for both “Modbus Master RTU/ASCII Port (Section 5.1)” and “Modbus Master TCP/UDP Port” are the same. Now, we have finished the setting to read AI data. Please click the item number (link to the Section 5.1.1~5.1.5) in the table below for the setting steps to read/write other data.

Items	Function Code	Modbus Request	Description
1	2	Read Input Bits	Read DI data
2	5	Write single coil bit	Write DO data
3	4	Read Input Registers	Read AI data
4	6	Write single holding register	Write one AO data (16-bit)
5	16	Write Holding Registers	Write multiple AO data (16/32 bits)

5.2.1 Connecting ET-7000 Series I/O Module

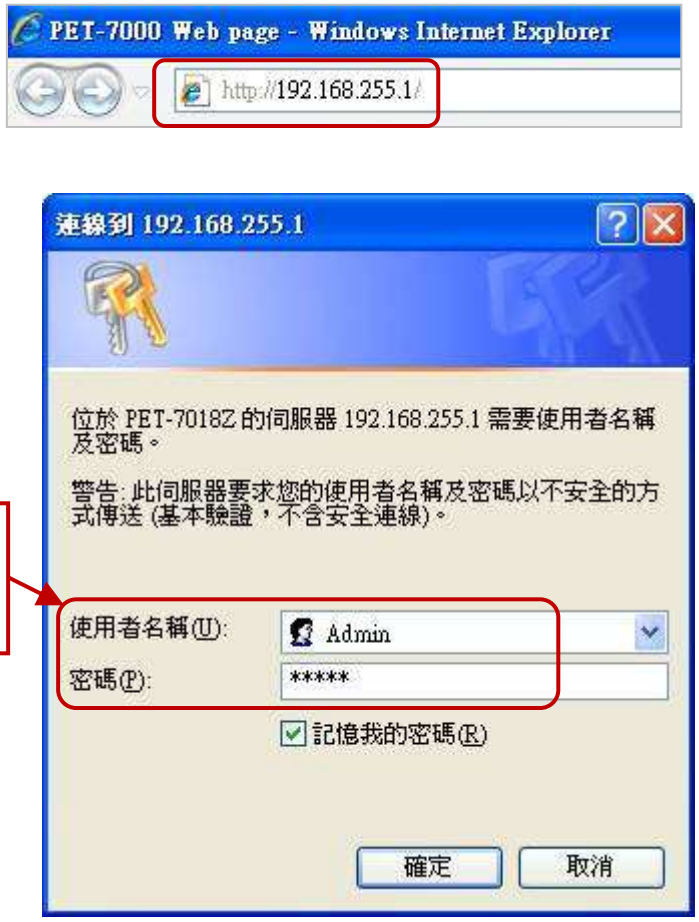
ICP DAS ET-7000 is a series of I/O module supporting Modbus TCP Slave protocol. The Win-GRAF PAC can enable the Modbus TCP Master to connect the ET-7000 modules. The maximum recommend amount of the connecting ET-7000 modules depends on the PAC model, such as the XP-8xx8-CE6, WP-5238 and WP-5248, recommends a maximum of 200; the WP-8xx8, VP-25W8 and VP-4138 is recommended that no more than 32.

For more information about the ET-7000 series products, please visit the website:
http://www.icpdas.com/root/product/solutions/remote_io/ethernet_io/ethernet_io_selection.html

Use Internet Browser to Set the ET-7000 Modules

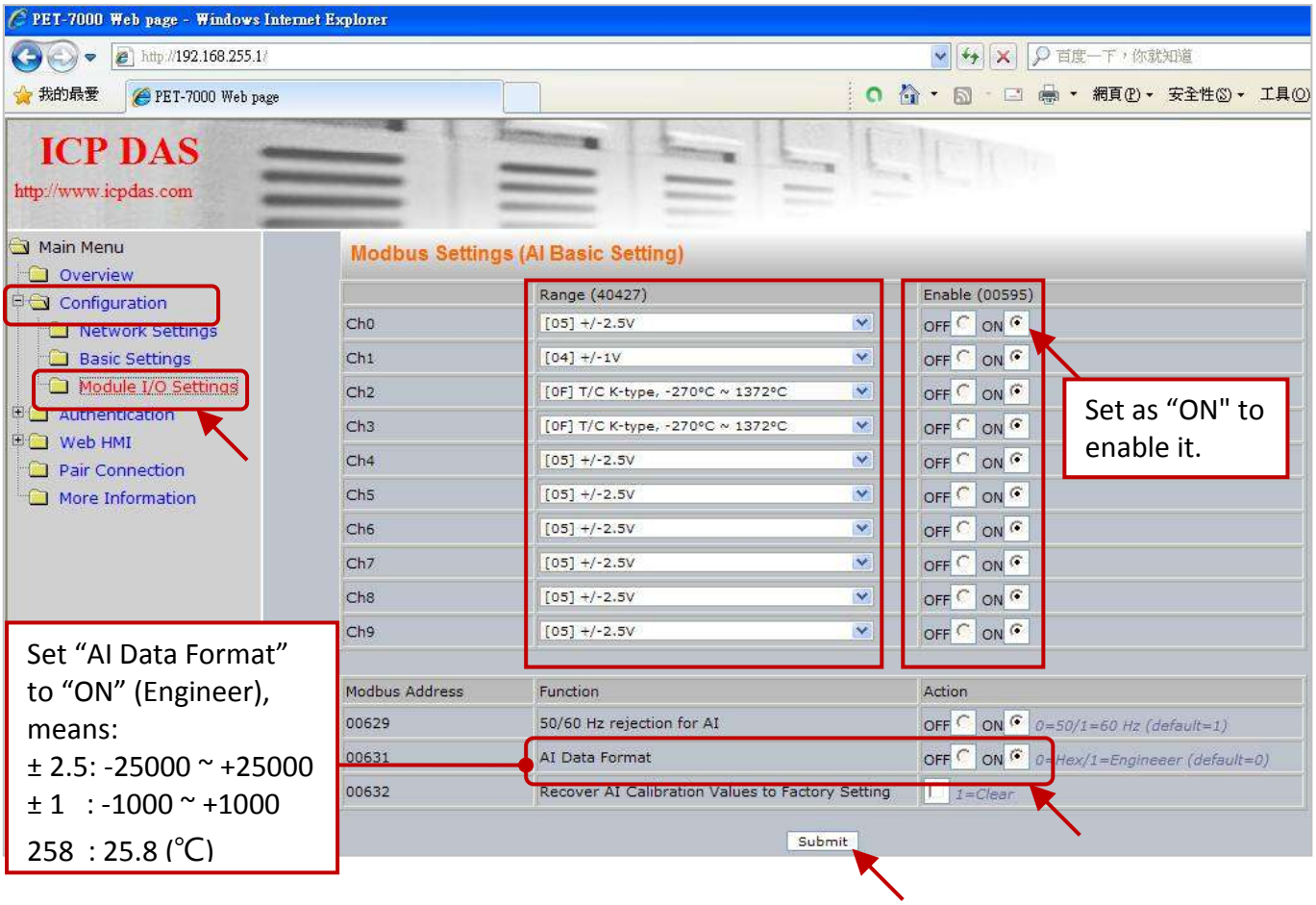
Before the first time using the ET-7000, you must set up the ET-7000 by using the Internet Browser. When the ET-7000 shipping from the factory, the settings are: IP address = 192.168.255.1; Mask = 255.255.0.0. Please set the IP of your PC in the same network (e.g., set the IP to 192.168.255.100, Mask = 255.255.0.0), then open the browser (such as IE), and enter the IP of the ET-7000 to connect it.

Notice: The Dip Switch on the rear of the ET-7000 must stay in the "Normal" position.



Username: Admin
Password: Admin
(Case sensitive)

Click “Configuration” > “Module I/O Settings” to set up the range of channels as below, and then click “Submit”.



Users can set the ET-7018Z‘s "AI Data Format" to "ON" (Engineering) for more convenient usage. For example:

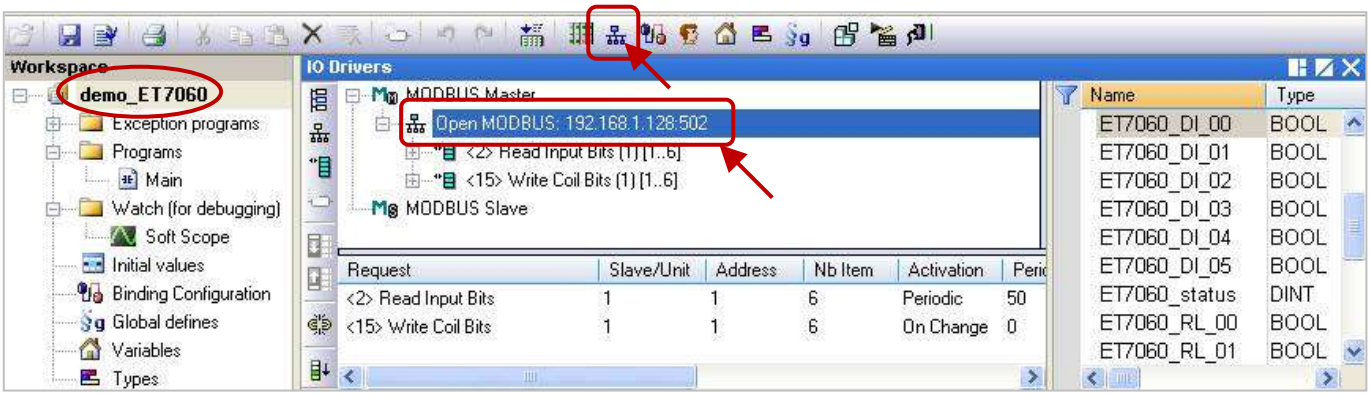
Type Code	Range	Data Format	Minimum	Maximum
04	-1 ~ +1 V	Engineering	-10000	+10000
		2’s comp HEX	8000h	7FFFh
05	-2.5 ~ +2.5 V	Engineering	-25000	+25000
		2’s comp HEX	8000h	7FFFh
18	Type M Thermocouple -200 ~ 100°C	Engineering	-20000	+10000
		2’s comp HEX	8000h	4000h

Restore/Open the Demo Project:

The Win-GRAF demo projects in the following sections can be found on the shipping CD, please refer Chapter 12. Click the menu bar "File" > "Add Existing Project" > "From Zip" can restore/open/check the demo projects. (CD-ROM:\Napdos\Win-GRAF\demo-project\)

Demo Project	File Name	Description
ET-7060	demo_ET7060.zip	Read 6 DIs, write 6 DOs
ET-7018Z	demo_ET7018z.zip	Read 10 AIs

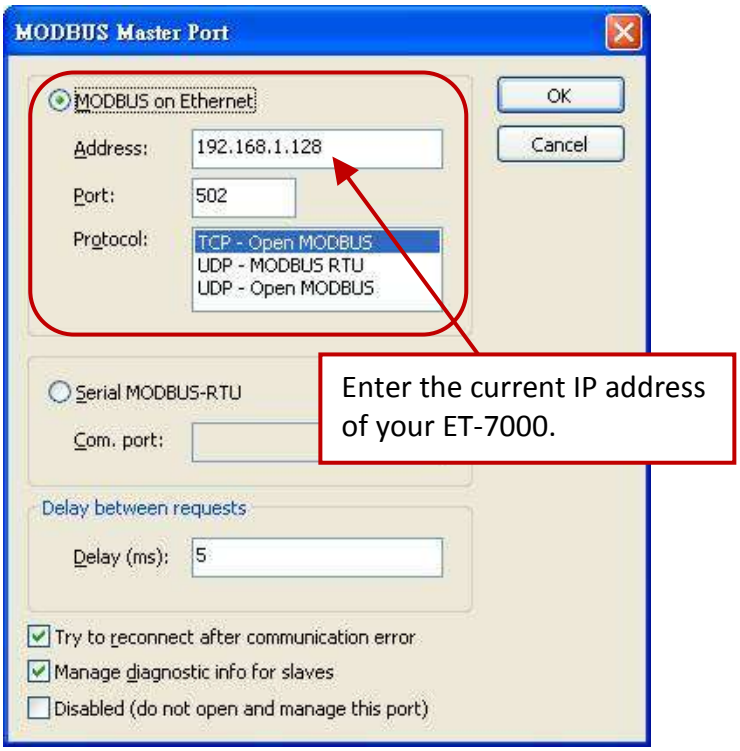
1. Click the tool icon “Open Fieldbus Configuration” to open the “I/O Drivers” window.



2. Double click “Open Modbus: IP:502” to open the “MODBUS Master Port” window.

Notice:

All demo projects in this chapter can enable the Win-GRAF PAC as a Modbus **TCP** Master. Please fill in the current IP address of your ET-7000, and set "Port" to "502” and "Protocol" to "TCP - Open Modbus".



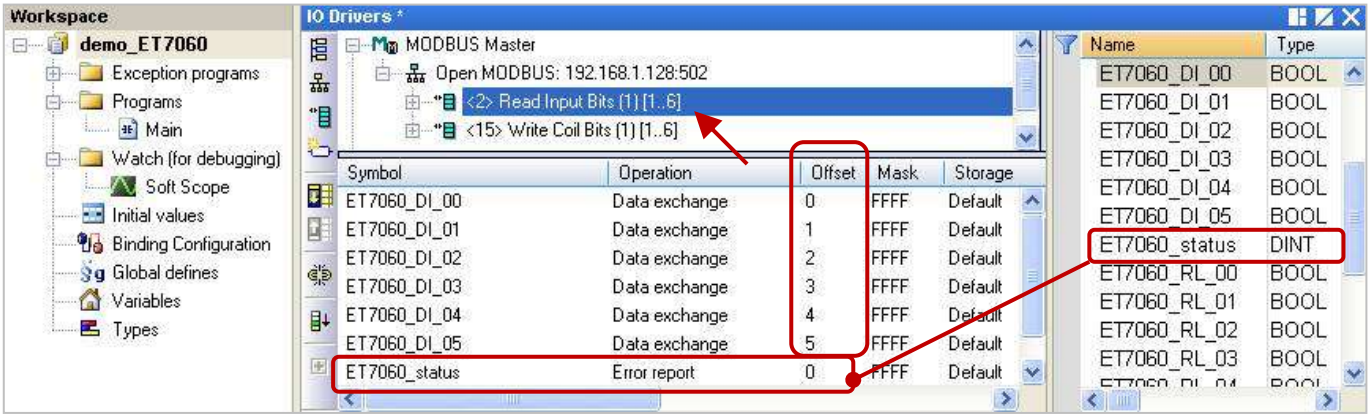
5.2.2 Connecting the ET-7060 (6 DI, 6 Relay)

The ET-7060 is a 6 DI and 6 Relay channels Ethernet I/O module. The Win-GRAF demo project for this section is "demo_ET7060.zip". Please refer Section 5.2.1 to set up the module channels using the Internet Browser, and restore/open the demo project.

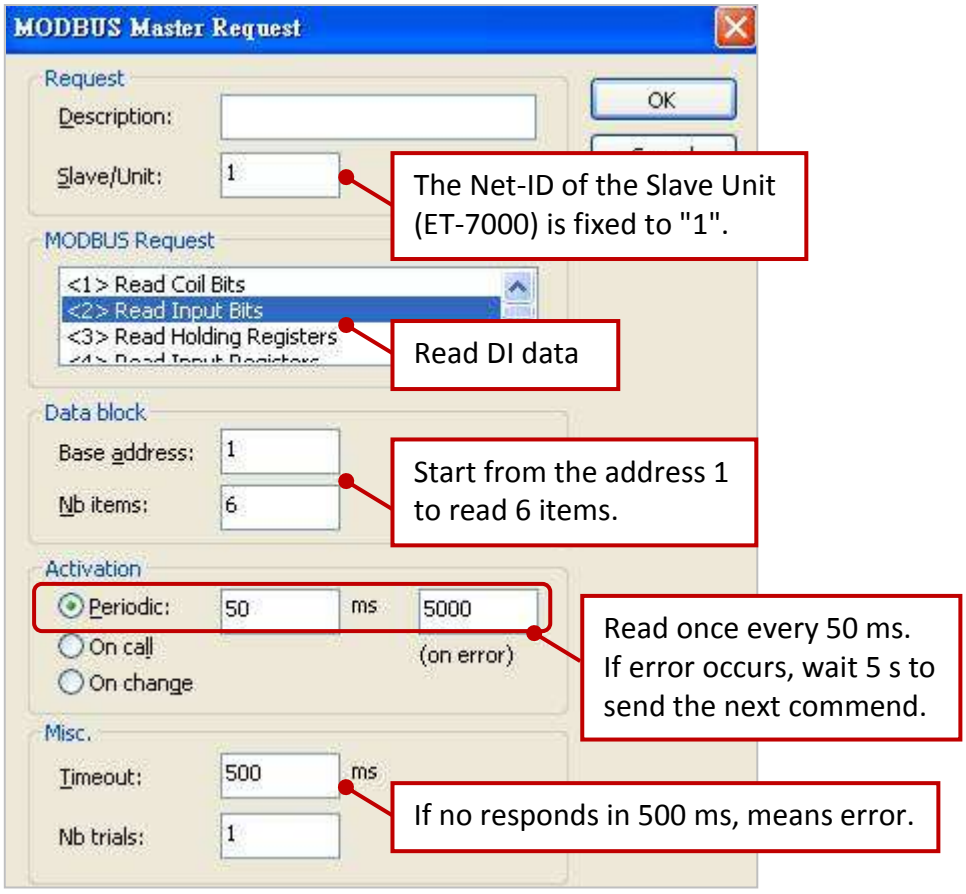
Demo Description:

This demo creates two Data Blocks, one is used to read 6 DI data, the other is used to write 6 DO data.

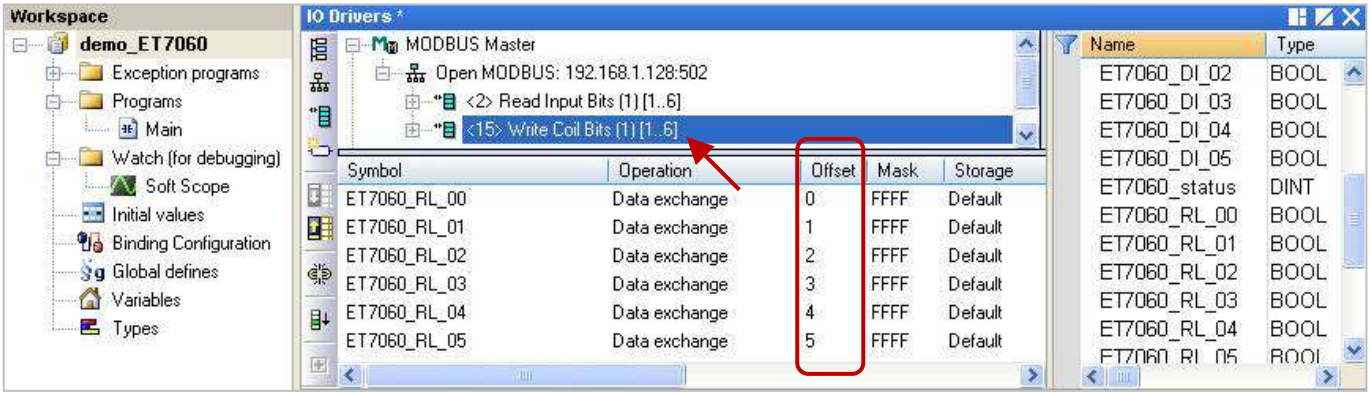
1. Double click the first Data Block (<2> Read Input Bits) to open the setting.

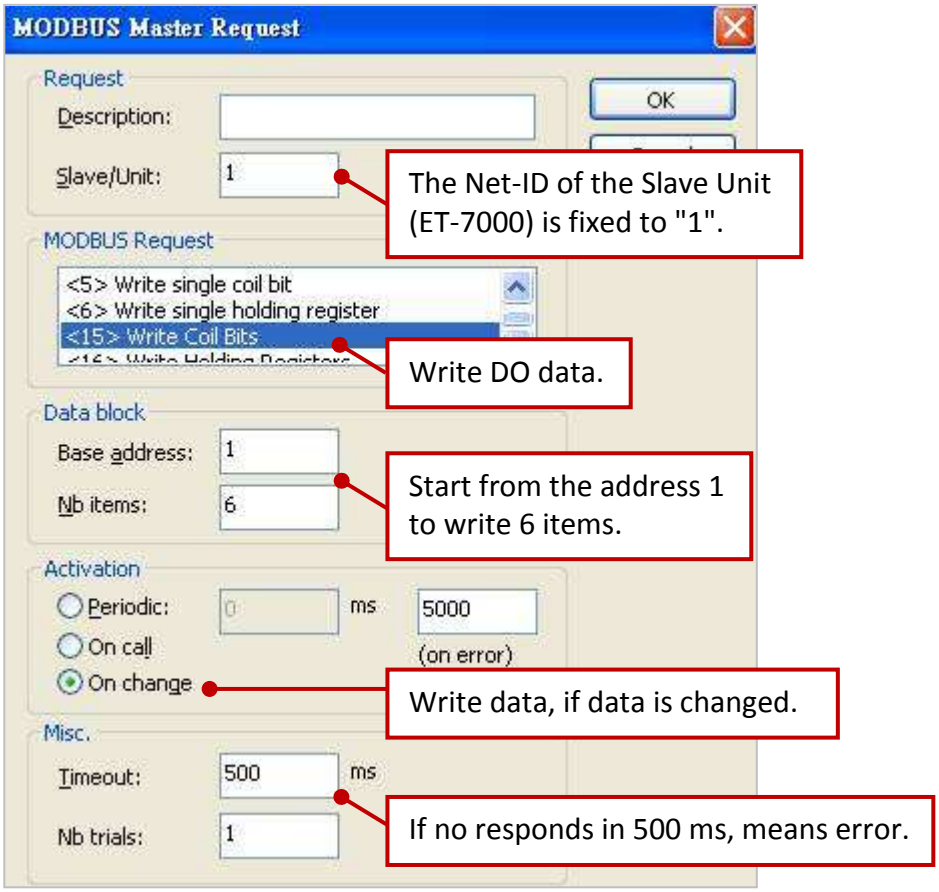


Notice: The value of the “Offset” starts from “0”, but the Modbus address of the variable is the “Offset” value plus 1 (Base address). If set the “Operation” to "Error report”, the “Offset” value of the variable (Data Type: DINT) must set to “0”.



2. Double click the second Data Block (<15> Write Coil Bits) to open the setting window.





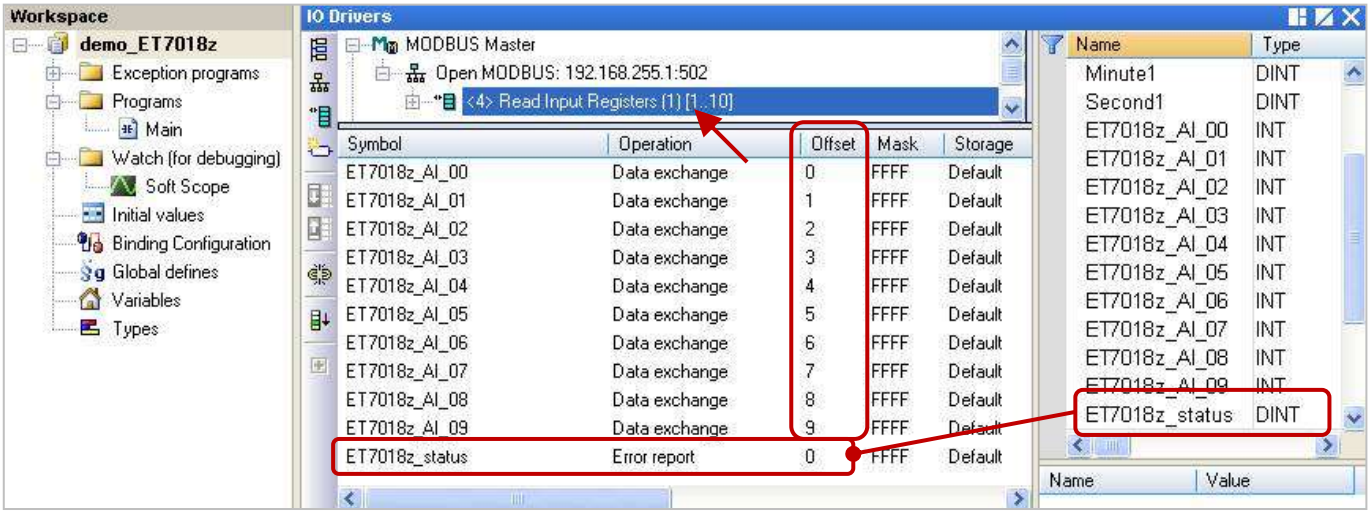
5.2.3 Connecting the ET-7018Z (10 AI)

The ET-7018Z is an 10 AI channels Ethernet I/O module. The Win-GRAF demo project for this section is "demo_ ET7018z.zip". Please refer Section 5.2.1 to set up the module channels using the Internet Browser, and restore/open the demo project.

Demo Description:

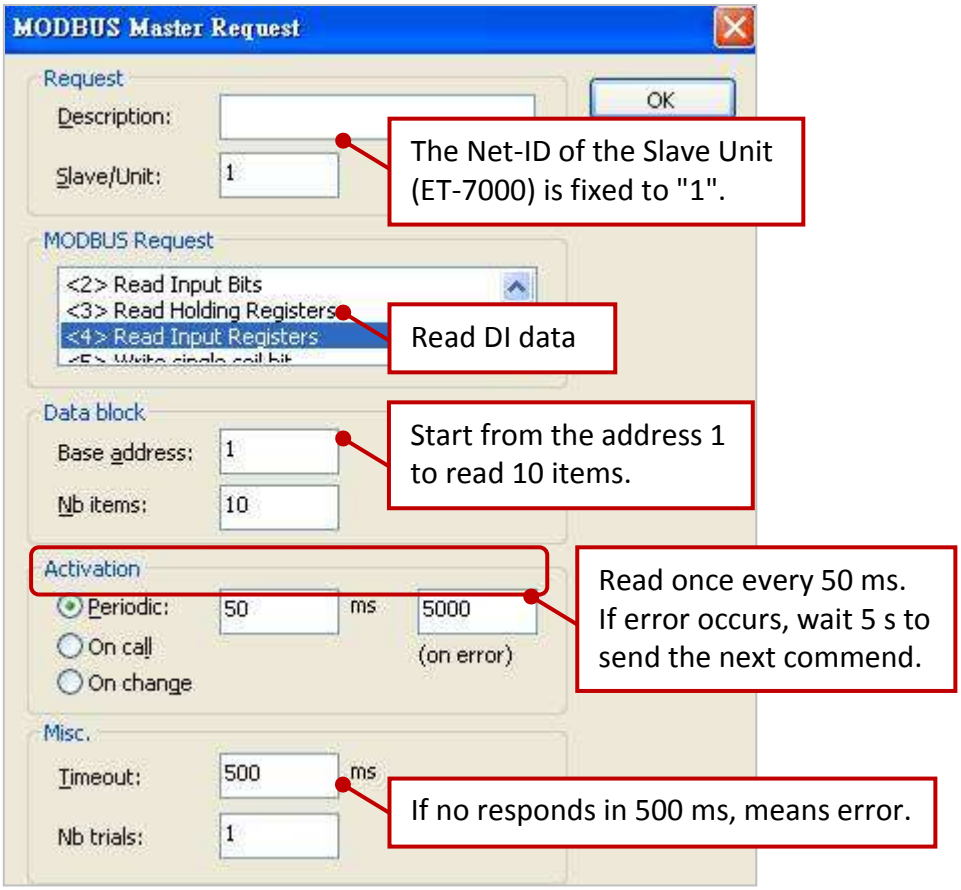
This demo creates one Data Block to read 10 AI data.

1. Double click the first Data Block (<4> Read Input Registers) to open the setting window.



Notice: 1. The value of the “Offset” starts from “0”, but the Modbus address of the variable is the “Offset” value plus 1 (Base address).

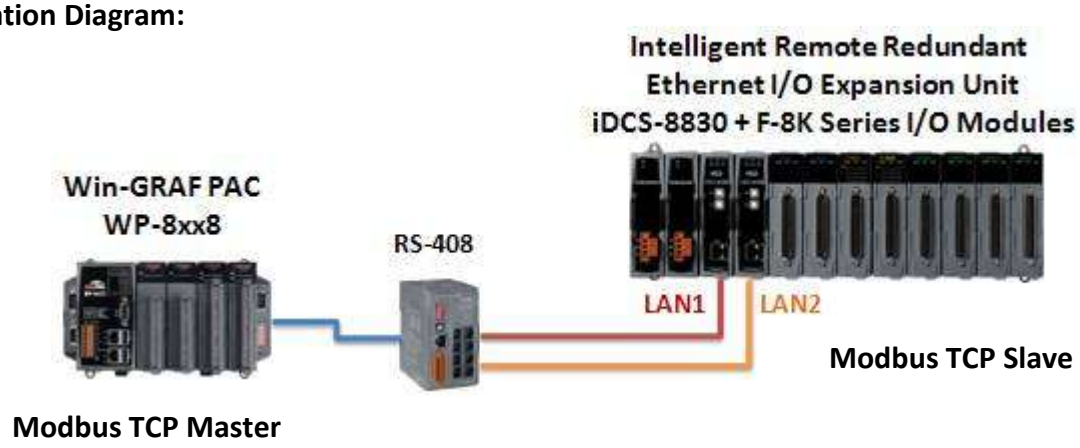
2. If set the “Operation” to "Error report”, the “Offset” value of the variable (Data Type: DINT) must set to “0”.
3. If AI range is -32768 ~ 32767, please declare the data type as "INT" for the variable.



5.3 Connecting the Modbus TCP Slave device has two IP addresses

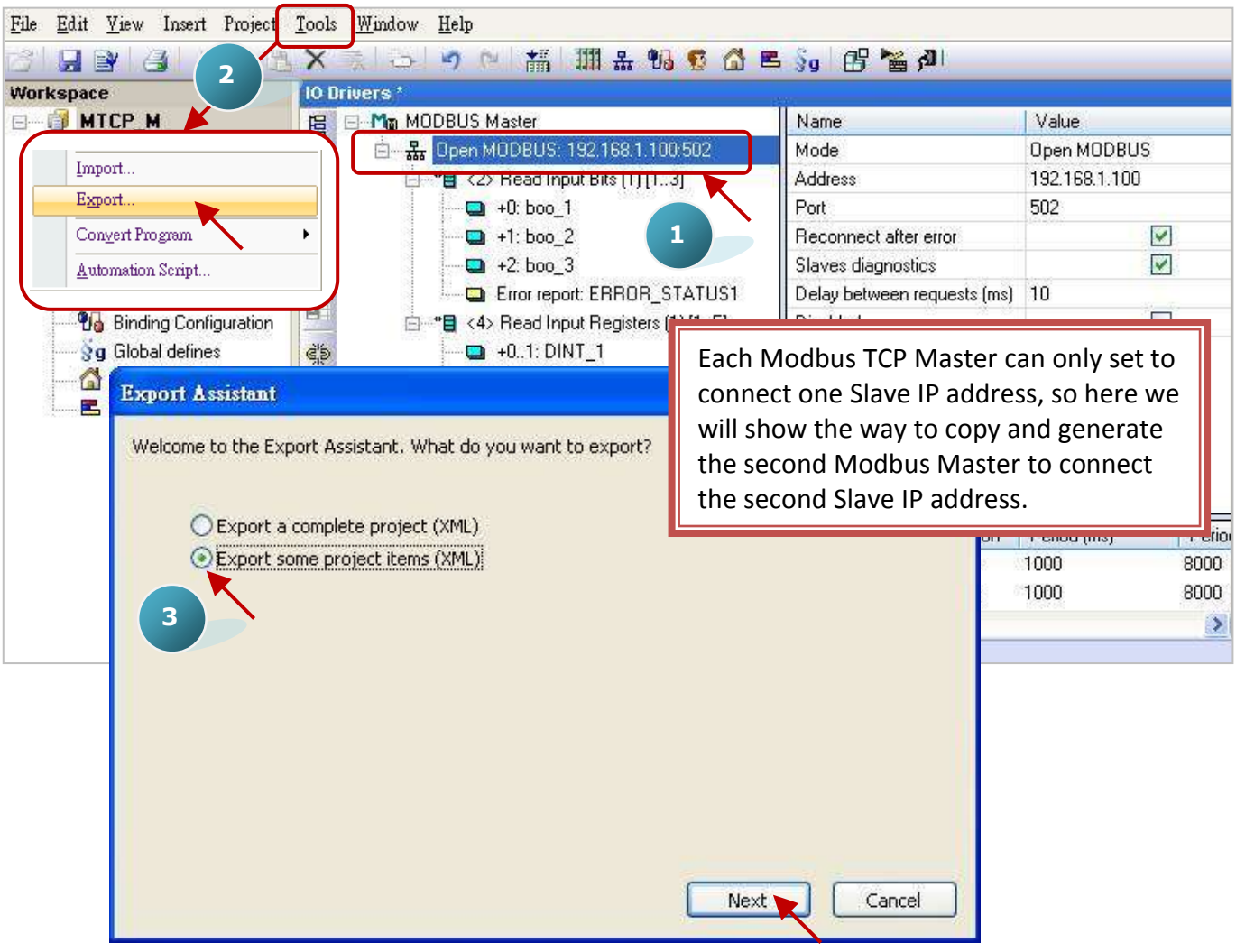
The previous section lists the way to enable the Win-GRAF PAC as a Modbus TCP Master device, and lists the way to read/write Modbus TCP Slave device. This section will list the way to create the redundant "Modbus Master Request", when one IP of the Modbus TCP Slave devices is disconnected, the other IP can still normally to be read/written data.

Application Diagram:

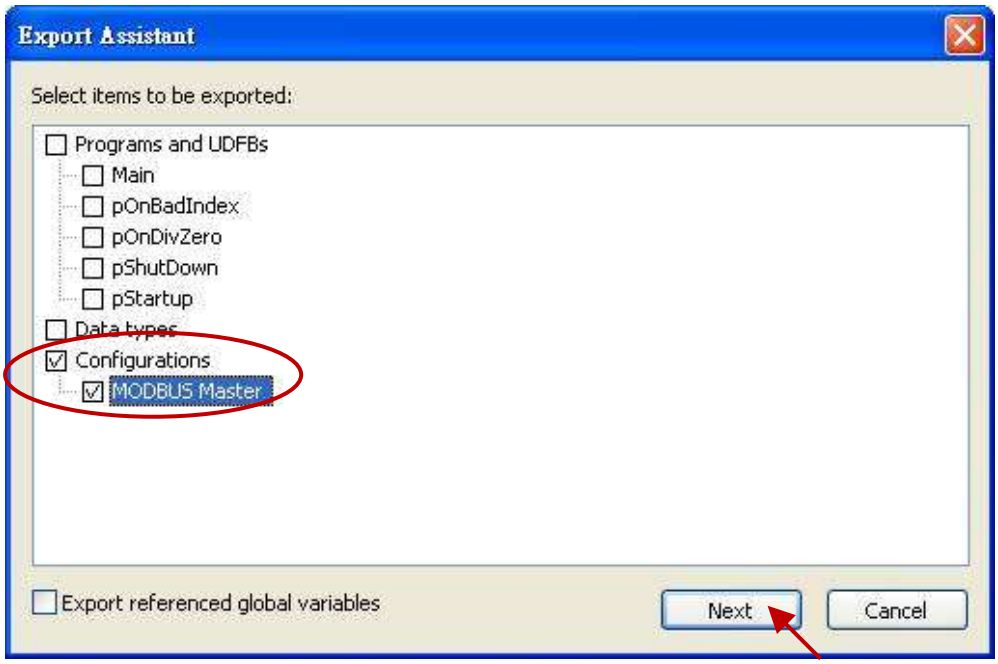


Follow The Steps:

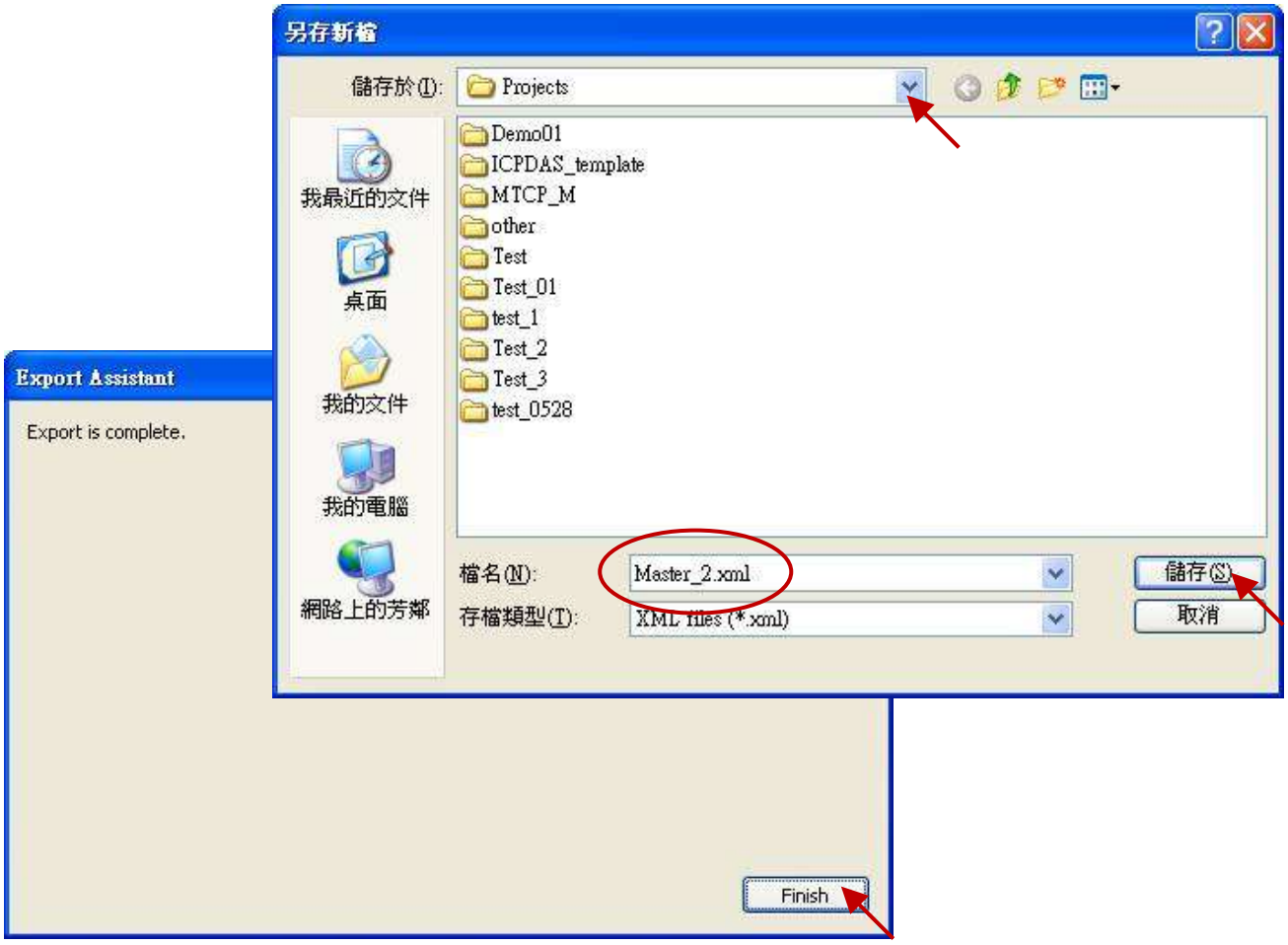
1. Click the “Open MODBUS:”, and then click the menu bar “Tools” > “Export”.
2. In the “Export Assistant” window, click “Export some project items (XNL)” and “Next”.



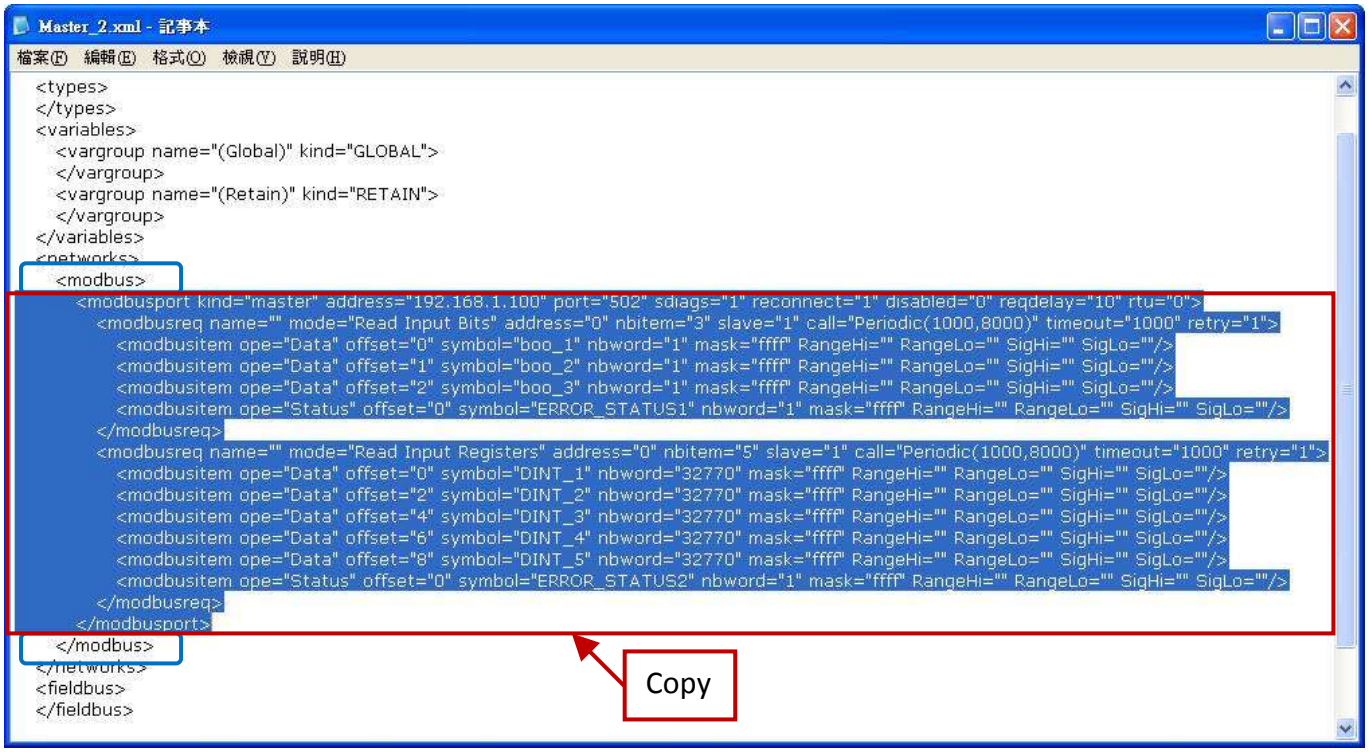
3. Check the “Configurations” and uncheck all other items, and then click “Next”.



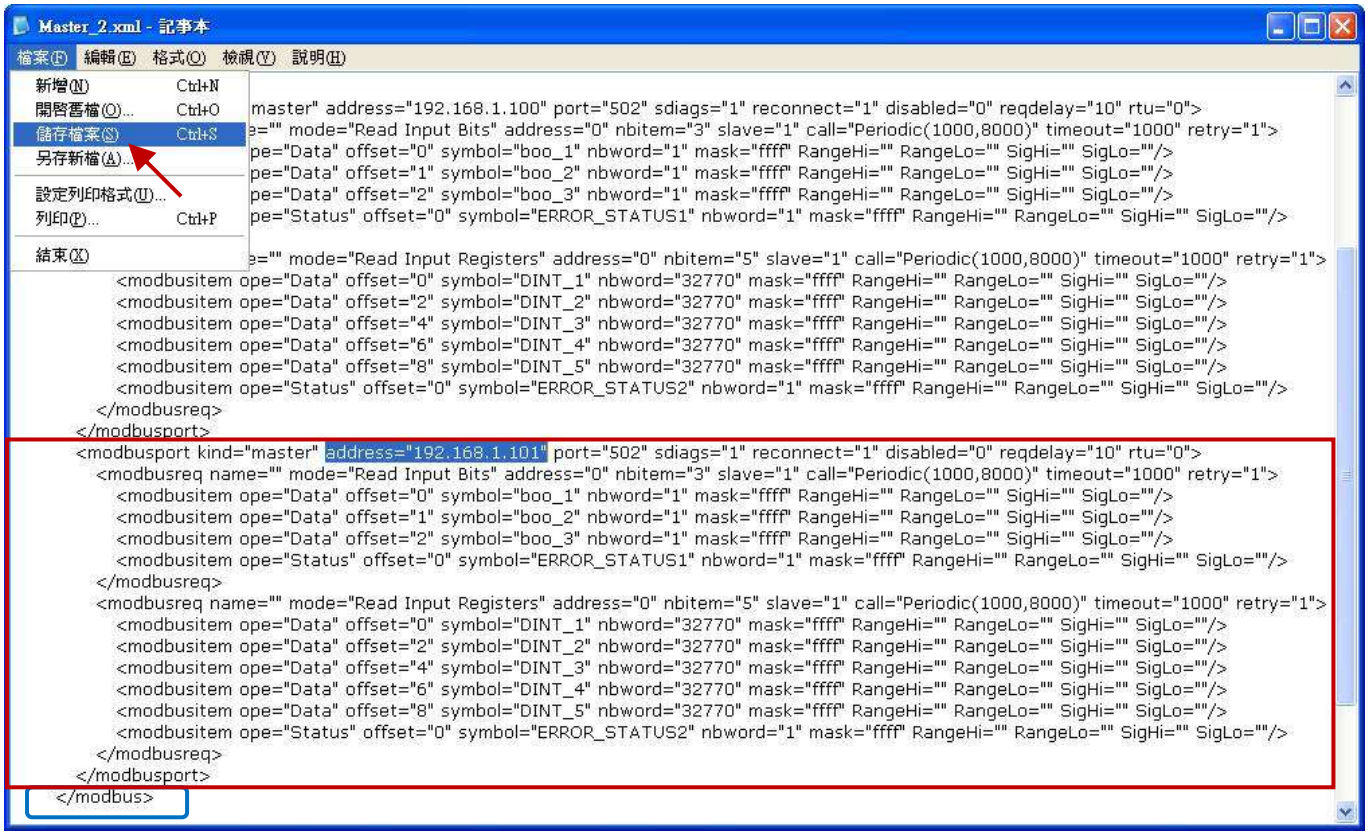
4. Browse a suitable path (default in C:\Win-GRAF\Projects) and named for the file (e.g., Master_2.xml), and then click "Save" button. Finally, click "Finish" to export the settings.



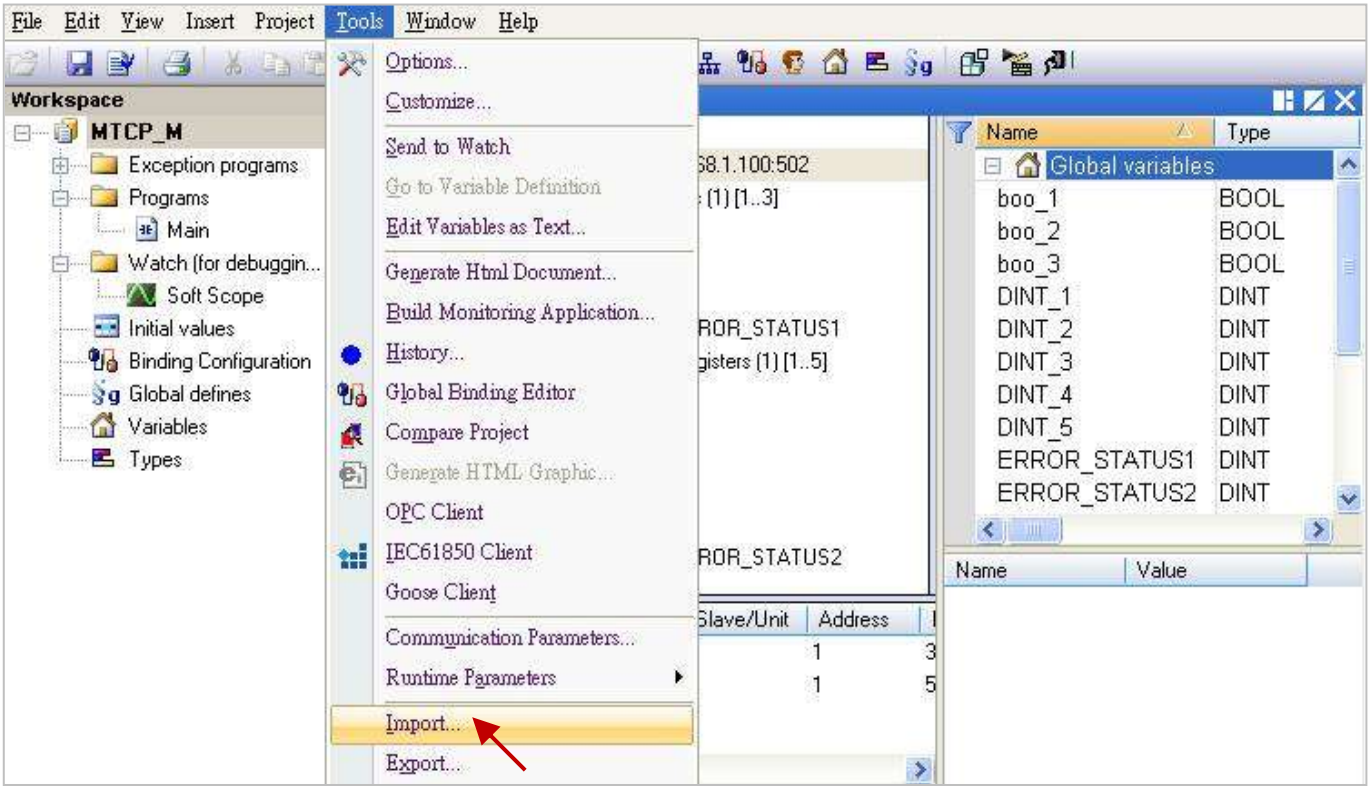
5. Using the Notepad software to open the file ".xml" that exported in the step 4, and then copy the content between the <modbus> and </modbus>.



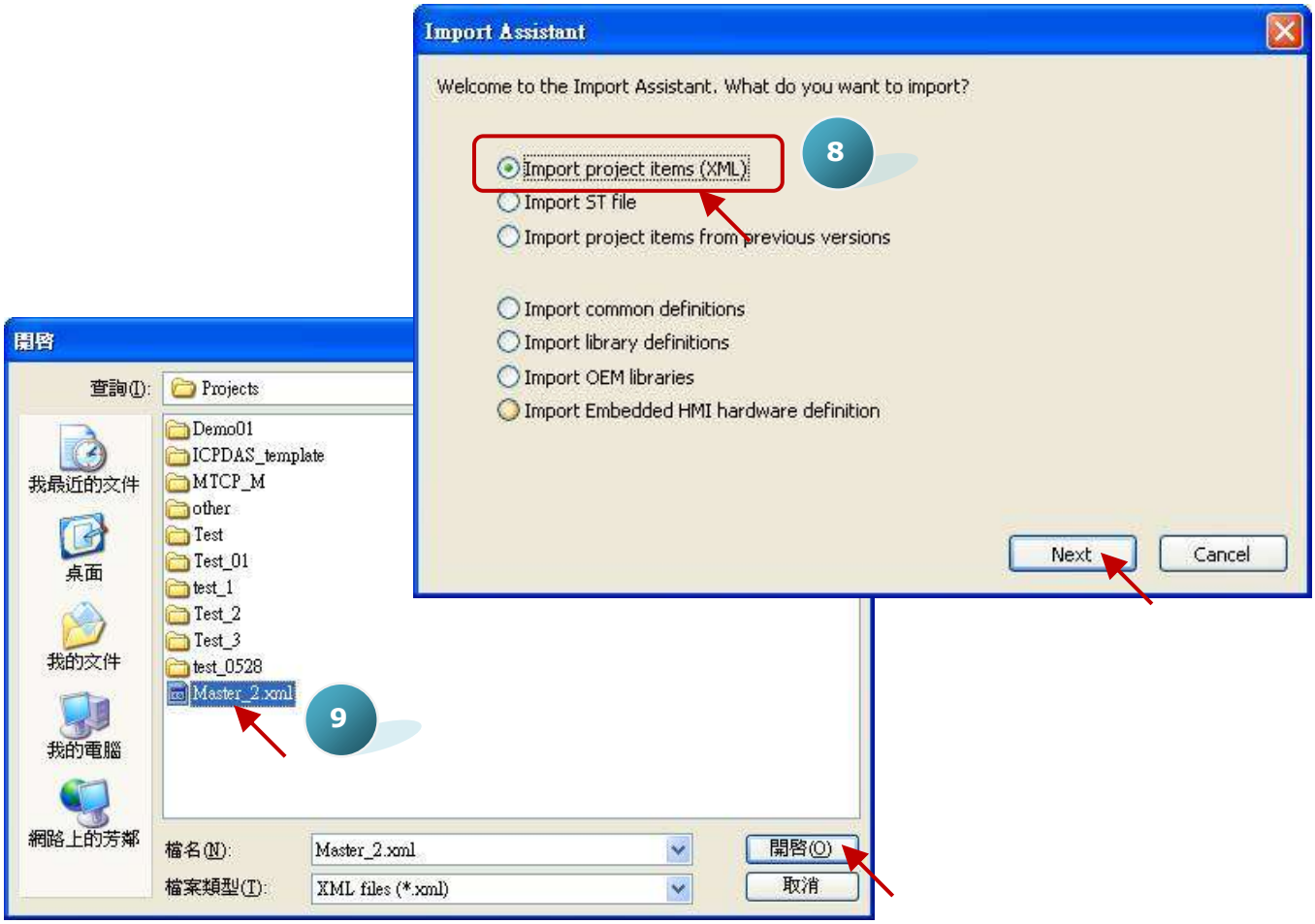
6. Paste the copied content above the </modbus>, and change the address to the second IP address of the Modbus Slave device (e.g., "192.168.1.101"), then save and close the file.



7. Click the Win-GRAF menu bar “Tools” > “Import”.



8. In the “Import Assistant” window, click “Import project items (XNL)” and “Next”.
9. Select the file you want to import (e.g., “Master_2.xml”) and click “Open” button.



10. Click “Finish” to finish the import action.

11. In the “IO Drivers” window, there has added a new “Open MODBUS” setting item that includes two “Modbus Master Request” for using to read the DI and AI. One “Error report” is used to check the IP connecting status, so please add two “DINT” variables in the Variable area (e.g., “ERROR_STATUS11”, “ERROR_STATUS21”) and double click the “Error report” to assign variables.